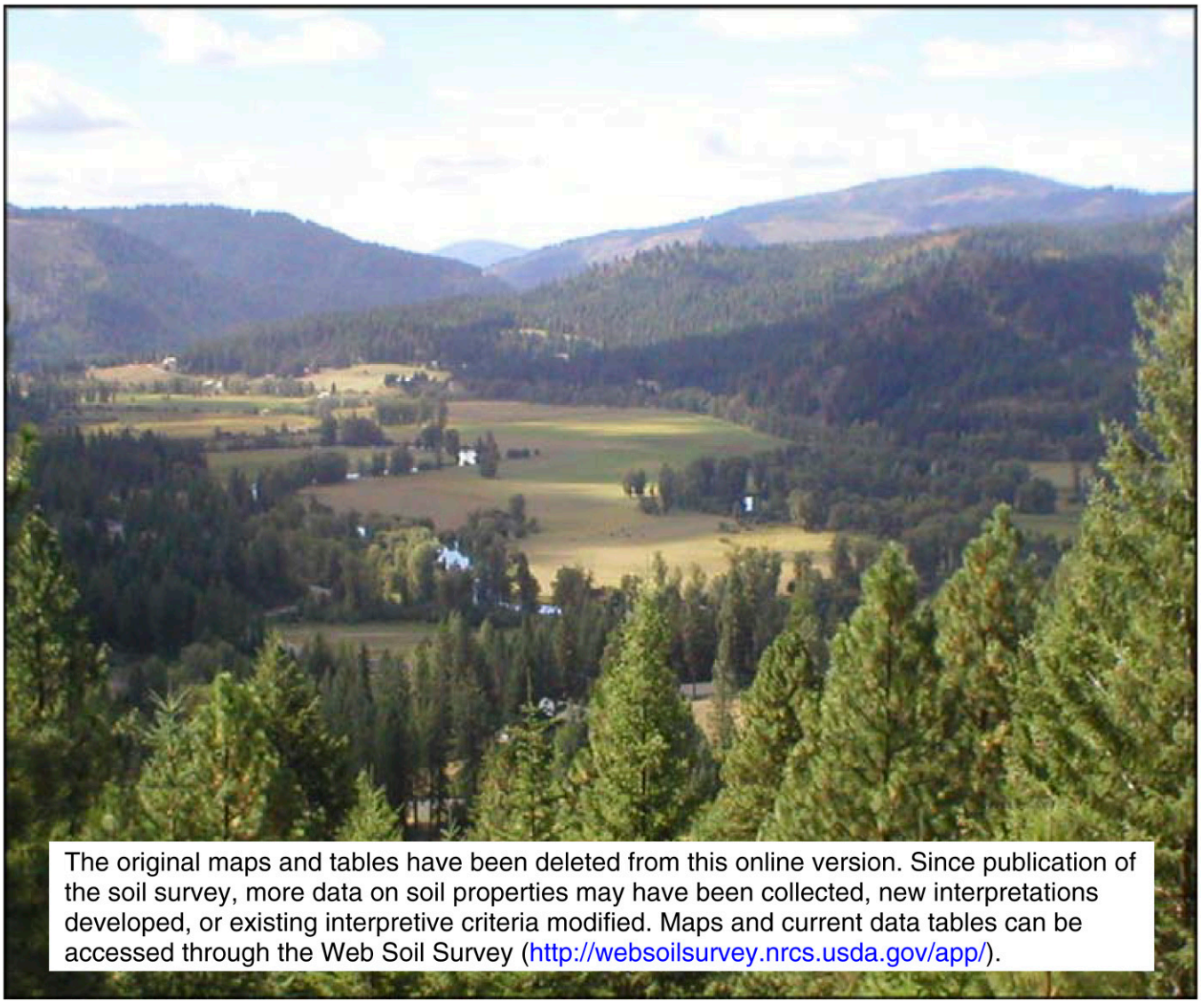
United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with the United States Department of the Interior, Bureau of Land Management; the University of Idaho, College of Agriculture; and the Idaho Conservation Commission

Soil Survey of St. Joe Area, Parts of Benewah and Shoshone Counties, Idaho



The original maps and tables have been deleted from this online version. Since publication of the soil survey, more data on soil properties may have been collected, new interpretations developed, or existing interpretive criteria modified. Maps and current data tables can be accessed through the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/).

How to Use This Soil Survey

General Soil Map

The general soil map shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section General Soil Map Units for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas. You can access the detailed soil maps at the Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/).

Go to the web site and follow the instructions to access the maps. Once the area of interest (AOI) has been selected, the “Soil Map” tab will provide a view of the detailed soil map and a legend that is hyperlinked to map unit descriptions. Click on the “Soil Data Explorer” tab to access the interpretations and reports. Report categories and subcategories include Suitabilities and Limitations for Use, Soil Properties and Qualities, and Soil Reports. Intrepretive data can also be accessed at the Soil Data Mart (http://soildatamart.nrcs.usda.gov/).

See the Contents for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1992. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service; the United States Department of the Interior, Bureau of Land Management; the University of Idaho, College of Agriculture; and the Idaho Soil Conservation Commission. It is part of the technical assistance furnished to the Benewah Soil and Water Conservation District and the Kootenai-Shoshone Soil Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: **Agatha and Bobbitt soils are on the mountains bordering the St. Maries River Valley. Miesen and Ramsdell soils are on the flood plain.**

*Additional information about the Nation's natural r*esources is available online from the Natural Resources Conservation Service at *http://www.nrcs.usda.gov.*

Contents

Issued 2002

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

Richard W. Sims
State Conservationist
Natural Resources Conservation Service

Soil Survey of St. Joe Area, Parts of Benewah and Shoshone Counties, Idaho

By Charles J. Weisel, Natural Resources Conservation Service

Fieldwork by Charles J. Weisel, Susanne M. Murphy, Peter F. Biggam, and Philip M. Hartwig, Natural Resources Conservation Service, and Scott H. Bare, Idaho Soil Conservation Commission

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the United States Department of the Interior, Bureau of Land Management; University of Idaho, College of Agriculture; and the Idaho Soil Conservation Commission

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. This information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the survey area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, soil scientists develop a concept, or model, of how the soils were formed. During mapping, this model enables soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates; kind and amount of rock fragments; distribution of plant roots; reaction; and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the

same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret data from these analyses and tests as well as field-observed characteristics and soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data for crop yields under high levels of management are modeled and validated with farm records and field or plot information on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Descriptions, names, and delineations of the soils in this survey area may not fully agree with those of the soils in adjacent survey areas. Differences result from a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Nature of the Survey Area

St. Joe Area is located in the central part of the Idaho panhandle (fig. 1). The survey area includes the eastern half of Benewah County and central and southern parts of Shoshone County. It is bounded on the north and east by the Idaho Panhandle National Forest and on the southwest by the Clearwater

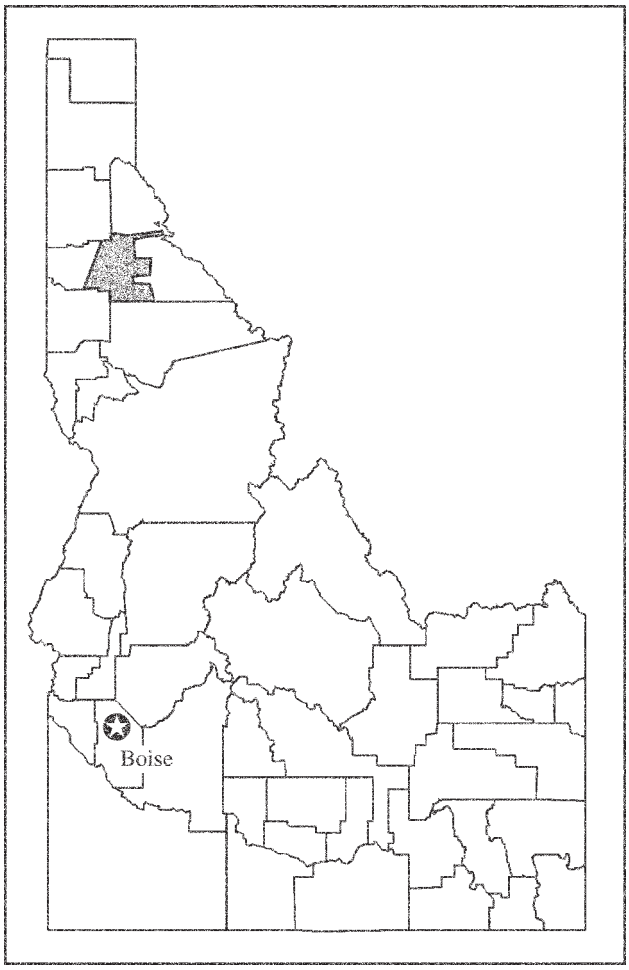


Figure 1.—Location of the St. Joe Area in Idaho.

National Forest. The St. Joe Area includes 721,800 acres or 1,128 square miles.

Most of the acreage in the survey area is woodland; however, a significant amount of acreage is used for hay and pasture.

St. Maries, the county seat of Benewah County, is located in the western part of the survey area. Wallace, the county seat of Shoshone County, is located in the northeastern part of the survey area.

Elevation ranges from about 2,140 feet above sea level along the major river drainages in the northeast and east to more than 6,000 feet at some of the mountain peaks, also in the eastern part of the survey area.

Two earlier surveys, “Soil Survey of Benewah County, Idaho” (USDA, 1930) and “Soil Survey of Benewah County Area” (USDA, 1980), and an interim survey, “Interim Soil Survey of Silver Valley Area, Idaho—Part of Shoshone County” (USDA, 1989), cover part of the present survey area. The present

survey updates the earlier surveys and provides additional information and larger maps that show the soils in greater detail.

Climate

St. Joe Area summers are warm to hot in most valleys and much cooler in the mountains. Winters are cold in the mountains. Valleys are cooler than the lower slopes of adjacent mountains because of cold air drainage. Precipitation occurs in the mountains throughout the year, and a deep snowpack accumulates during winter. Snowmelt usually supplies much more water than can be used for agriculture in the area. Precipitation occurs in the valleys during summer as showers and thunderstorms. In winter, the ground is covered with snow much of the time. Chinook winds, which blow downslope and are warm and dry, often melt and evaporate the snow.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Kellogg and St. Maries for the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 29 degrees F and the average daily minimum temperature is 23 degrees F. The lowest recorded temperature, which occurred at Kellogg, is -36 degrees F. In summer, the average temperature is 65 degrees F, and the average daily maximum temperature is 82 degrees F. The highest recorded temperature, which occurred at Kellogg, is 111 degrees F.

Growing-degree days, as shown in Table 1, are equivalent to heat units. During the month, growing-degree days accumulate by the amount the average temperature each day exceeds a base temperature (40 degrees F). The normal growing-degree accumulation is used to schedule single or successive plantings of crops between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 30 inches. Of this, 33 percent usually falls in April through September. The growing season for most crops falls within this period. Thunderstorms occur approximately 15 days each year, occurring mostly in summer.

The average seasonal snowfall is 55 inches but varies from 10 to over 100 inches. At least 1 inch of snow is on the ground an average of 28 days; however, the number of such days varies from year to year.

The average relative humidity in midafternoon is about 45 to 50 percent. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines 75 percent of the time in summer and 30 percent of the time in winter. The prevailing wind is from the southwest. Average windspeed is highest, 10 miles per hour, in spring.

Physiography and Drainage

The St. Joe Area consists of rugged, forested, mountainous or hilly terrain and comparatively narrow valleys that open to the west. The Coeur d'Alene Mountains are in the northern part of the survey area and the St. Joe Mountains are in the southern part. The most prominent valleys in the area are the St. Joe and the Coeur d'Alene River valleys. Other valleys include the St. Maries River Valley, in the southern part of the survey area, and the Emida River Valley, in the southern part of Benewah County.

The survey area has many creeks and rivers, both large and small. The St. Joe and Coeur d'Alene rivers, which flow from east to west across the area, are the principal drainages. The St. Maries River is the main drainage that flows from the southern part of the survey area. It joins the St. Joe River at the town of St. Maries.

History and Development

The earliest inhabitants of the survey area were of Salishan ancestry. The Coeur d'Alene Indians used the areas along the lower St. Joe and Coeur d'Alene rivers for hunting, fishing, and gathering edible berries and roots.

European habitation in the area began in the early 1800s with the French fur trade; later Jesuit missionaries arrived. The first Jesuit mission was established in 1842 near the St. Joe River. It was not long after this that homesteaders laid claim to the area, often settling on Coeur d'Alene Indian lands.

Captain John Mullan of the United States Army built the first road through the area in 1859. It was a military road that ran from Fort Benton, Montana, to Fort Walla Walla, Washington, and essentially followed a route along the South Fork of the Coeur d'Alene River. The first settlers to the area came by way of the Mullan Trail or up the St. Joe or Coeur d'Alene rivers.

The area soon became known for its vast timber stands. The St. Joe and Coeur d'Alene River valleys became the centers of large-scale logging activity. Logs were transported by flumes, river log drives, horses, and train. The historic wildfire of 1910 destroyed vast areas of timber and many small logging communities as it raged through the area.

In 1881, Andrew J. Prichard discovered gold north of Wallace, near the present community of Murray. News of the rich discovery brought thousands of miners and prospectors to the Coeur d'Alene River Valley area (Silver Valley). Although the gold soon played out, rich ore bodies of silver, lead, and zinc were discovered. These and other metals have been mined and produced in the Silver Valley area for the past 100 years. The communities of Kellogg and Wallace became the hub of one of the richest mining districts in the world. Smelting operations ceased in 1982 when the Bunker Hill site was placed on the National Priorities List as an EPA Superfund Site (U.S. Environmental Protection Agency, 1986).

Shoshone County was established in 1858, and Benewah County was established in 1915. The town of St. Maries, which started as a sawmill site in 1889, became the county seat of Benewah County. St. Maries has grown over the decades as a center for the area's timber industry. In 1990, St. Maries had a population of 2,440; Wallace had a population of 1,010; and Kellogg had a population of 2,590. The population of the entire area has fluctuated with the amount of activity in the mining and lumber industries.

Agriculture

About 50,000 acres in the survey area are used for hay and pasture. Most of this acreage is grass-legume hay and pasture that is not irrigated. Yields are low to moderate when compared with those in nearby counties. The low yields are a result of the cool temperatures and short growing season.

Most of the hay and pasture in the survey area is on cutover timberland. Some of it is wet bottomlands and meadows along the St. Joe, St. Maries, and Coeur d'Alene rivers. Most of the farms and ranches are part-time enterprises that are supplemented by off-farm employment or by income from the timber industry. Timber production is the most profitable enterprise in the area and is carried out by both individual landowners and large timber companies. Christmas tree production is proving quite profitable where proper management is used.

Livestock grazing is becoming more important to the economy of the area. The livestock operations are cow-calf or beef enterprises, generally including less than 100 cows. Some of the large timber companies lease out their cutover timberlands for livestock grazing or maintain their own livestock operations. Some of the federal- and state-owned lands are also leased out for livestock grazing.

The average size of individual farms and ranches in the area is about 300 acres, of which about 75 acres are hay or pasture and the rest is woodland. Large corporate timberland tracts range in size from 1,000 acres to over 30,000 acres.

Industry and Transportation

The timber and mining industries continue to be very important to the economy of the area. St. Maries has several plants that supply forest products, and other plants are located throughout the survey area. Many of the mines in the Silver Valley area have been closed in recent years, but a few are still in operation.

In addition to logging and mining, the St. Joe Area's natural scenic beauty and outdoor recreation opportunities have brought tourism to the forefront as an important part of the economy.

Transportation facilities are presently supplied by railroads, highways, and airports at St. Maries and Kellogg. Graded roads, many of which were built for logging and mining, extend along the principal streams and rivers in the survey area. Two major highways run through the St. Joe Area—Interstate Highway 90 runs east and west through the northern part, and State Highway 3 runs north and south through the southwestern part.

Natural Resources

Millions of board feet of timber are cut annually from Douglas-fir, grand fir, ponderosa pine, spruce, western hemlock, western larch, western red cedar, and western white pine. Dimensional lumber is the major product. Small quantities of posts, poles, house logs, and veneer are also produced.

The survey area has abundant water resources. Three major rivers—St. Joe, St. Maries, and Coeur d'Alene—dominate the landscape. Overall, water quality in the area is considered to be very good, except for the South Fork of the Coeur d'Alene River, which has been affected by past mining and smelting activities. Although the major wetlands are adjacent to the principal rivers, small wetlands are scattered throughout the survey area.

Mining activities began in the Coeur d'Alene River Valley area in about 1885. Antimony, cadmium, copper, gold, lead, silver, and zinc have since been mined. Over the years, this mining district has produced metals valued at over 4.6 billion dollars. A few small placer gold deposits are still being mined in the Murray area; however, their current value is insignificant. Commercial garnet placer deposits are being mined in the Emerald Creek area of Benewah County. The principal market for these garnets is the metal cleaning industry.

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, each map unit consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. A map unit is named for the major soils or miscellaneous areas. The components of one map unit can occur in another map unit but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general soil map for this soil survey does not join, in all instances, with the general soil maps of adjacent survey areas. Differences in the maps have resulted from differences in the occurrence of soil patterns and from recent advances in classification.

The general soil map units in this survey have been grouped for broad interpretive purposes. Each of the broad groups and the map units in each group are described on the following pages.

Moderately Steep to Very Steep, Well-Drained Soils on Mountains

Percent of the survey area: 68

1. Ahrs-Pinecreek-Lotuspoint

Dominantly moderately deep and very deep, steep and very steep, well-drained soils on mountains and mountain breaklands (fig. 2)

Setting

Landscape: Mountains and mountain breaklands throughout the survey area
Slope range: 35 to 75 percent
Elevation: 2,160 to 4,800 feet
Mean annual air temperature: 42 to 49 degrees F
Frost-free period: 90 to 140
Mean annual precipitation: 28 to 42 inches

Composition

Percent of the survey area: 9
Minor components: Blackprince, Tigley, and Honeyjones soils and Rock outcrop

Major Uses: Timber production, livestock grazing, recreation, wildlife habitat, and watershed

2. Honeyjones-Ahrs

Dominantly very deep, moderately steep to very steep, well-drained soils on mountains (fig. 3)

Setting

Landscape: Mountains and mountain breaklands throughout the survey area
Slope range: 15 to 85 percent
Elevation: 2,200 to 4,800 feet
Mean annual air temperature: 41 to 46 degrees F
Frost-free period: 60 to 110
Mean annual precipitation: 30 to 45 inches

Composition

Percent of the survey area: 25
Minor components: Rock outcrop and Pinecreek, Latour, and Hugus soils

Major Uses: Timber production, livestock grazing, recreation, wildlife habitat, and watershed

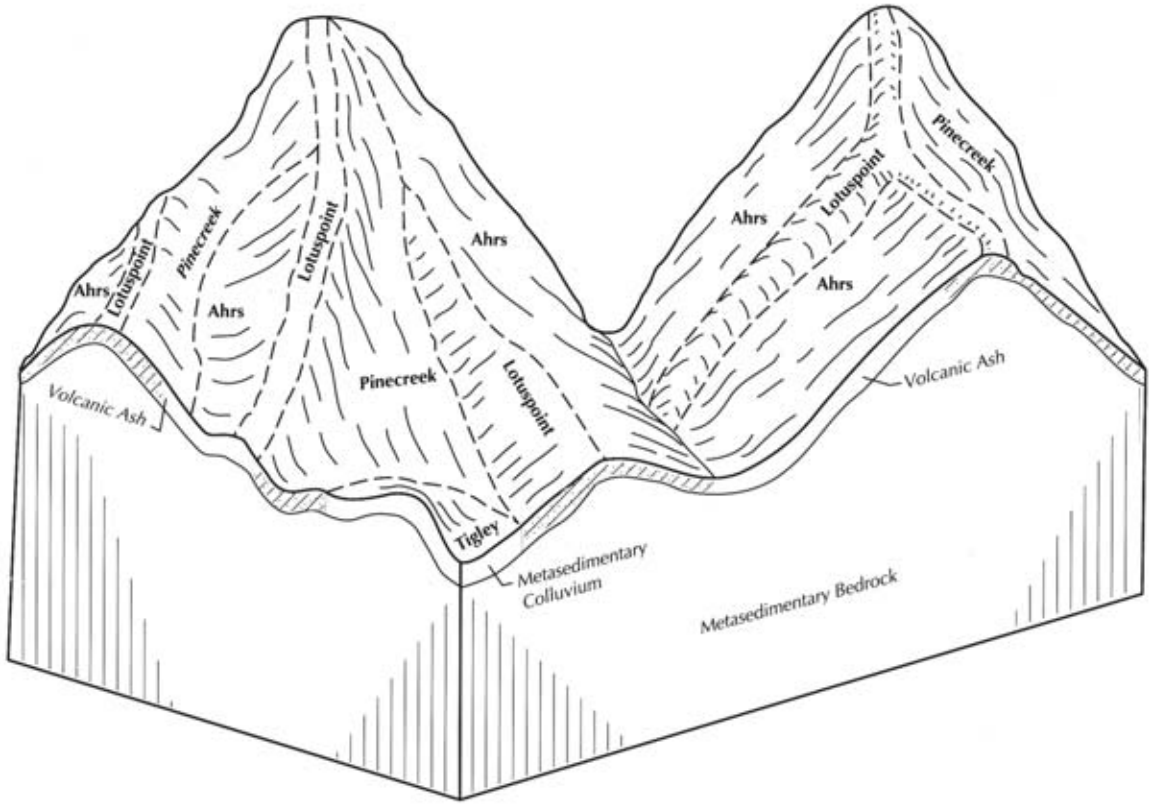


Figure 2.—Typical pattern of soils and underlying material in General Soil Map Unit 1.

3. Latour-Vaywood-Rubble land

Dominantly very deep, moderately steep to very steep, soils and rubble land on mountains and ridges at high elevations

Setting

Landscape: Mountains and ridges at high elevations throughout the survey area
Slope range: 15 to 75 percent
Elevation: 4,600 to 6,500 feet
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60
Mean annual precipitation: 40 to 55 inches

Composition

Percent of the survey area: 7
Minor components: Joebaldy, Goatrock, Daveggio, and Redraven soils

Major Uses: Timber production, livestock grazing, recreation, wildlife habitat, and watershed

4. Jacot-Keeler-Garveson

Dominantly very deep, moderately steep to very steep, soils on mountains and foothills

Setting

Landscape: Mountains and foothills in the central and southeastern part of the survey area
Slope range: 15 to 65 percent
Elevation: 2,200 to 4,800 feet
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 70 to 110
Mean annual precipitation: 30 to 65 inches

Composition

Percent of the survey area: 4
Minor components: Floodwood, Odonnell, Blackprince, and Nakarna soils

Major Uses: Timber production, livestock grazing, recreation, wildlife habitat, watershed, and homesites

5. Nakarna-Flewsie

Dominantly deep and very deep, moderately steep to very steep, soils on mountains and foothills (fig. 4)

Setting

Landscape: Mountains and foothills in the south-central part of the survey area
Slope range: 15 to 65 percent
Elevation: 2,800 to 4,800 feet
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 70 to 100
Mean annual precipitation: 35 to 50 inches

Composition

Percent of the survey area: 9
Minor components: Helmer, Bouldercreek, Marblecreek, and Keeler soils

Major Uses: Timber production, livestock grazing, recreation, wildlife habitat, and watershed

6. Bouldercreek-Marblecreek

Dominantly very deep, moderately steep to very steep, well-drained soils on mountains (fig. 5)

Setting

Landscape: Mountains in the southern half of the survey area
Slope range: 15 to 75 percent
Elevation: 2,600 to 5,000 feet
Frost-free period: 60 to 110
Mean annual air temperature: 42 to 46 degrees F
Mean annual precipitation: 35 to 50 inches

Composition

Percent of the survey area: 14
Minor components: Rock outcrop and Nakarna, Blackprince, Flewsie, and Kruse soils

Major Uses: Timber production, livestock grazing, recreation, wildlife habitat, and watershed

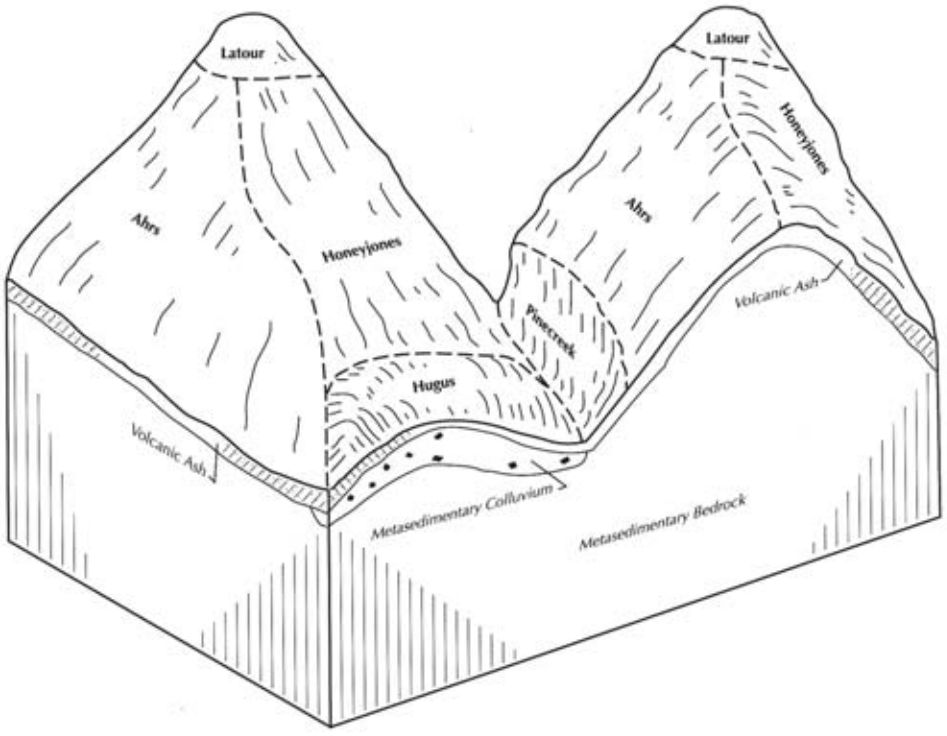


Figure 3.—Typical pattern of soils and underlying material in General Soil Map Unit 2.

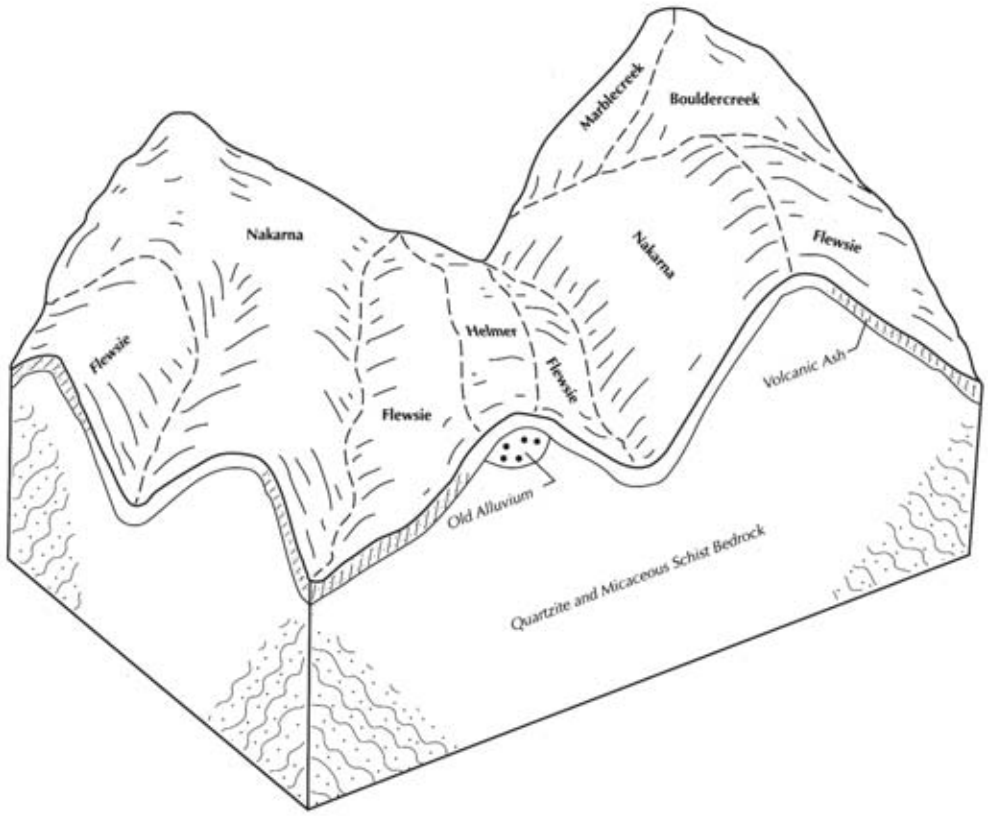


Figure 4.—Typical pattern of soils and underlying material in General Soil Map Unit 5.

Moderately Steep to Very Steep, Moderately Well-drained and Well-drained Soils on Dissected Terraces and Foothills

Percent of the survey area: 11

7. Hugus-Tigley-Hobo

Dominantly very deep, moderately steep to very steep, soils on dissected terraces and foothills (fig. 6)

Setting

Landscape: Dissected terraces and foothills adjacent to the Coeur d'Alene and St. Joe rivers and in the southeastern part of Benewah County
Slope range: 15 to 65 percent
Elevation: 2,160 to 4,000 feet
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 80 to 120
Mean annual precipitation: 30 to 50 inches

Composition

Percent of the survey area: 11
Minor components: Helmer, Honeyjones, Ahrs, Pinecreek, and Lotuspoint soils

Major Uses: Timber production, livestock grazing, recreation, wildlife habitat, and watershed

Steep and Very Steep, Well-drained Soils on Basalt Terrace Escarpments and Canyonsides

Percent of the survey area: 3

8. Agatha-Dorb-Bobbitt

Dominantly moderately deep and deep, steep and very steep soils on basalt terrace escarpments and canyonsides

Setting

Landscape: Basalt terraces, escarpments, and canyonsides in the west-central part of the survey area
Slope range: 35 to 65 percent
Elevation: 2,150 to 3,200 feet
Mean annual air temperature: 42 to 49 degrees F
Frost-free period: 80 to 130
Mean annual precipitation: 28 to 35 inches

Composition

Percent of the survey area: 3
Minor components: Lacy soils, Rock outcrop, Ahrs and Honeyjones soils, and Agatha soils on slopes of less than 35 percent

Major Uses: Timber production, livestock grazing, recreation, and wildlife habitat

Undulating to Steep, Moderately Well-drained and Well-drained Soils on Old Alluvial and Basalt Terraces

Percent of the survey area: 14

9. Helmer-Sly-Hobo

Dominantly shallow to a fragipan and very deep, undulating to steep, moderately well-drained and well-drained soils on old alluvial and basalt terraces (fig. 7)

Setting

Landscape: Old alluvial and basalt terraces in the western and central parts of the survey area
Slope range: 3 to 40 percent
Elevation: 2,140 to 3,800 feet
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 70 to 110
Mean annual precipitation: 30 to 45 inches

Composition

Percent of the survey area: 10
Minor components: Hugus, Reggear, Agatha, Honeyjones, and Ahrs soils

Major Uses: Timber production, livestock grazing, hay and pasture, homesites, recreation, and wildlife habitat

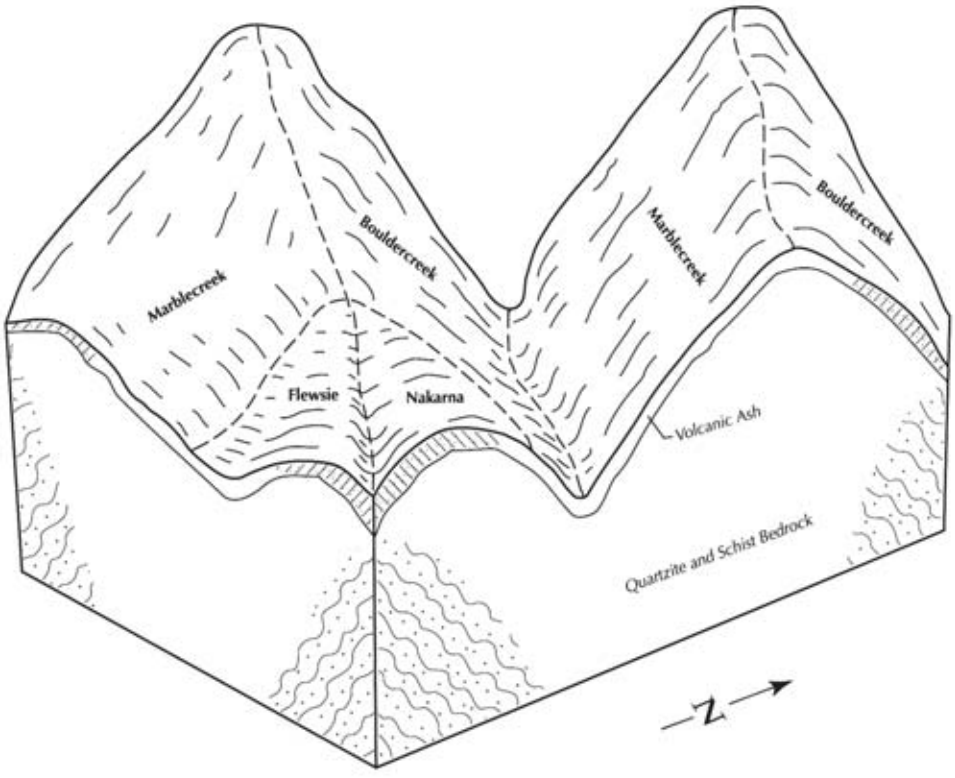


Figure 5.—Typical pattern of soils and underlying material in General Soil Map Unit 6.

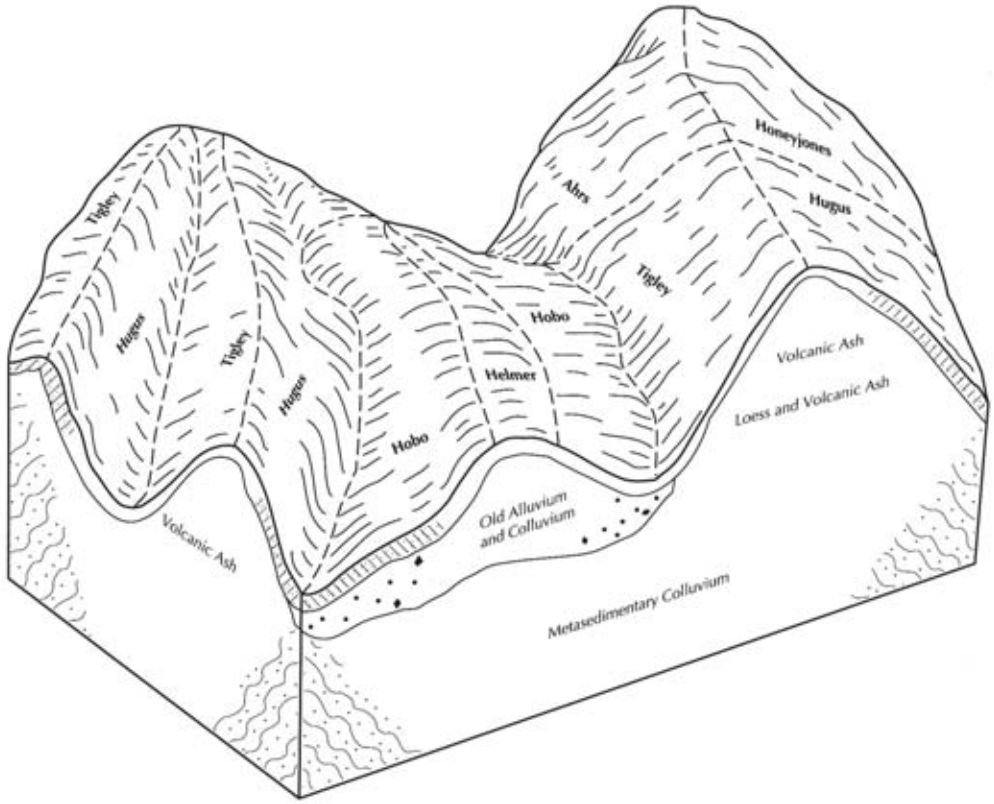


Figure 6.—Typical pattern of soils and underlying material in General Soil Map Unit 7.

10. Reggear

Dominantly moderately deep to a fragipan, undulating to moderately steep, moderately well-drained soils on basalt terraces

Setting

Landscape: Loess-covered basalt terraces in the southwestern part of the survey area
Slope range: 3 to 30 percent
Elevation: 2,500 to 3,400 feet
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110
Mean annual precipitation: 30 to 40 inches

Composition

Percent of the survey area: 4
Minor components: Helmer, Hobo, Bechtel, Clarkia, and Agatha soils

Major Uses: Timber production, livestock grazing, hay and pasture, homesites, recreation, and wildlife habitat

Level to Nearly Undulating, Very Poorly Drained to Somewhat Poorly Drained Soils on Valley Floors, Flood Plains, Low Stream Terraces, and Drainageways

Percent of the survey area: 4

11. Miesen-Ramsdell-Bellslake

Dominantly very deep, level to undulating, very poorly drained to somewhat poorly drained soils on flood plains and low stream terraces

Setting

Landscape: Flood plains and low stream terraces adjacent to the St. Joe River in the central part of the survey area
Slope range: 0 to 4 percent
Elevation: 2,120 to 2,240 feet
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120
Mean annual precipitation: 28 to 32 inches

Composition

Percent of the survey area: 1
Minor components: Mazie, Clarkia, Aquic Udifluvents, and Pokey soils

Major Uses: Hay and pasture, recreation, wildlife habitat, and homesites in some areas

12. Clarkia-Pokey-Typic Fluvaquents

Dominantly very deep, level to undulating, very poorly drained to somewhat poorly drained soils on flood plains and low stream terraces

Setting

Landscape: Flood plains, low stream terraces, and drainageways in the southwestern part of the survey area
Slope range: 0 to 4 percent
Elevation: 2,200 to 3,200 feet
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 80 to 110
Mean annual precipitation: 35 to 45 inches

Composition

Percent of the survey area: 1
Minor components: Mazie, Aquic Udifluvents, Ramsdell, Helmer, and Udarents soils

Major Uses: Hay and pasture, recreation, and wildlife habitat

13. Aquic Udifluvents-Udarents-Slickens

Dominantly very deep, level to undulating, somewhat poorly drained soils and areas of Slickens on flood plains, low stream terraces, and valley floors

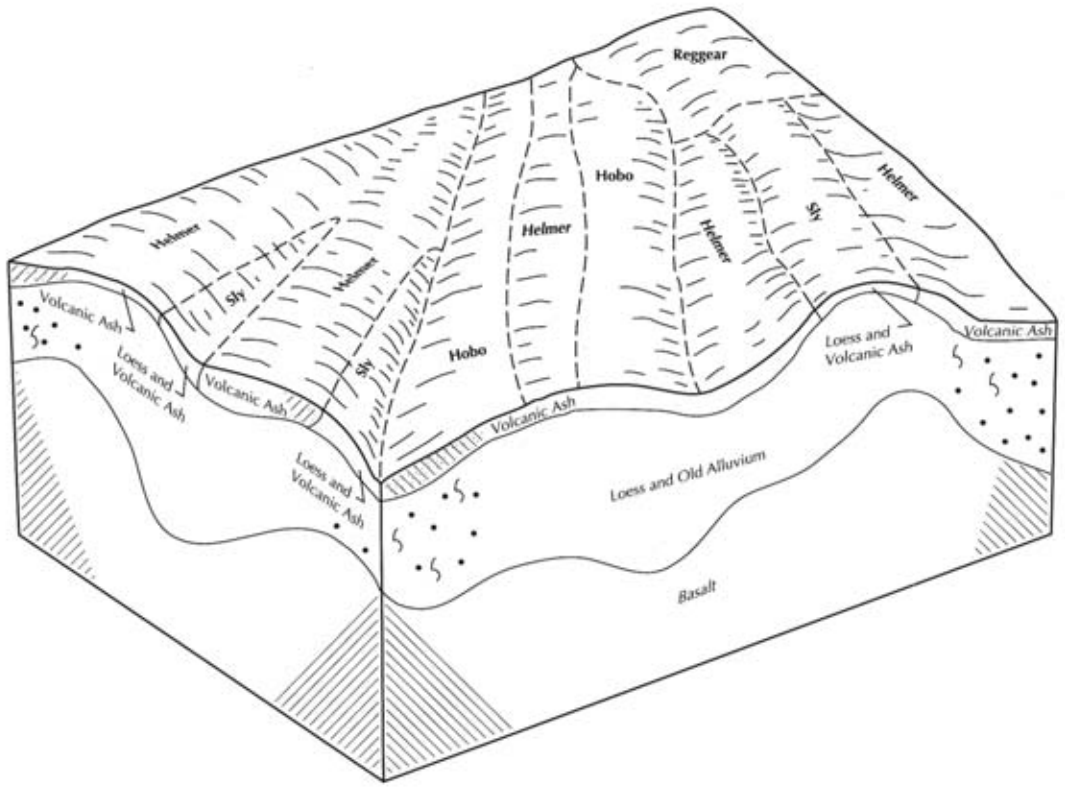


Figure 7.—Typical pattern of soils and underlying material in General Soil Map Unit 9.

Setting

Landscape: Flood plains, stream terraces, and valley floors in the northern and western parts of the survey area
Slope range: 0 to 4 percent
Elevation: 2,135 to 3,300 feet
Mean annual air temperature: 42 to 47 degrees F
Frost-free period: 80 to 130
Mean annual precipitation: 30 to 45 inches

Composition

Percent of the survey area: 2
Minor components: Typic Fluvaquents, Miesen, Ramsdell soils, and Mine dumps

Major Uses: Livestock grazing, hay and pasture, homesites and urban development, mining activities, recreation, and wildlife habitat

Detailed Soil Map Units

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each description is followed by the detailed soil map units associated with the series.

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff, 1975). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given under the heading "Use and Management of the Soils."

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class, there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in a particular map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They are generally in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and, consequently, they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all of the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all of the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their

use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Honeyjones gravelly silt loam, 65 to 85 percent slopes, is a phase of the Honeyjones series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

This survey includes *complexes.* They consist of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Helmer-Sly silt loams, 3 to 25 percent slopes, is an example.

This survey includes *associations*. They are made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Honeyjones-Ahrs association, 35 to 75 percent slopes, is an example.

This survey includes *miscellaneous areas*. They have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (See "Contents") give properties of the soils and the limitations, capabilities, and potentials for many uses. Many of the terms used in describing the soils or miscellaneous areas are defined in the "Glossary."

Soil Descriptions

1—Agatha stony loam, 5 to 35 percent slopes

Composition

Agatha and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: East- and west-facing canyonsides and escarpments
Slope range: 5 to 35 percent
Slope features: Convex
Elevation: 2,160 to 3,200 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—2 inches
0 to 5 inches—brown stony loam
5 to 27 inches—brown and light brown very cobbly loam
27 to 48 inches—light yellowish brown extremely stony clay loam
48 inches—hard, fractured basalt bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from basalt with a mantle of loess
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Bobbitt and Lacy soils on south-facing terrace escarpments and ridges
- Dorb soils on north-facing canyonsides and terrace escarpments
- Ahrs soils on lower positions of east- and west-facing slopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Homesites
- Recreation
- Wildlife habitat

Woodland

Woodland suitability subclass: 6F
Trees suitable for planting: Douglas-fir and grand fir
Mean site index: Grand fir—64 (50-year site curve)
Estimated average annual production (CMAI): Grand fir—83 cubic feet per acre at 117 years of age
Dominant vegetation in potential natural plant community: Grand fir, western white pine, western larch, Douglas-fir, ponderosa pine, lodgepole pine, mallow ninebark, common snowberry, and creambush oceanspray

Management limitations:
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use conventional methods in harvesting timber.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Elk sedge, pine reedgrass, Columbia brome, strawberry, sweetscented bedstraw, American trailplant, baldhip rose, mallow ninebark, common snowberry, Rocky Mountain maple, white spirea, and creambush oceanspray
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Septic tank absorption fields can be expected to function poorly because of the restricted permeability of the soil.
- Deep excavation is hampered by the limited depth to bedrock.

Management practices:
- Design and construct buildings and roads to compensate for slope.
- Design and construct roads and trails to compensate for large stones.
- Design and construct septic tank absorption fields to compensate for restricted soil permeability and slope.

Interpretive Groups

Capability class: VIe

2—Agatha stony loam, 35 to 65 percent slopes

Composition

Agatha and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: East- and west-facing canyonsides and escarpments
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,160 to 3,200 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—2 inches
0 to 5 inches—brown stony loam
5 to 27 inches—brown and light brown very cobbly loam
27 to 48 inches—light yellowish brown extremely stony clay loam
48 inches—hard, fractured basalt bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from basalt with a mantle of loess
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Severe

Inclusions

Contrasting inclusions:
- Bobbitt and Lacy soils on south-facing terrace escarpments and ridges

- Dorb soils on north-facing canyonsides and terrace escarpments
- Ahrs soils on lower positions of east- and west-facing slopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Woodland suitability subclass: 6R
Trees suitable for planting: Douglas-fir and grand fir
Mean site index: Grand fir—64 (50-year site curve)
Estimated average annual production (CMAI): Grand fir—83 cubic feet per acre at 117 years of age
Dominant vegetation in potential natural plant community: Grand fir, western white pine, western larch, Douglas-fir, ponderosa pine, lodgepole pine, mallow ninebark, common snowberry, and creambush oceanspray
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Elk sedge, pine reedgrass, Columbia brome, strawberry, sweetscented bedstraw, American trailplant, baldhip rose, mallow ninebark, common snowberry, Rocky Mountain maple, white spirea, and creambush oceanspray
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Excavation increases the risk of water erosion.
- Deep excavation is hampered by the limited depth to bedrock.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope and large stones.
- Preserve the existing plant cover during construction to reduce the risk of erosion.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.

Interpretive Groups

Capability class: VIIe

3—Agatha-Bobbitt stony loams, 35 to 65 percent slopes

Composition

Agatha and similar soils: 45 percent
Bobbitt and similar soils: 30 percent
Contrasting inclusions: 25 percent

Agatha

Setting

Landscape position: East- and west-facing canyonsides and escarpments (fig. 8)
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,160 to 3,200 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—brown stony loam
5 to 27 inches—brown and light brown very cobbly loam
27 to 48 inches—light yellowish brown extremely stony clay loam
48 inches—hard, fractured basalt bedrock

Figure 8.—An area of Agatha-Bobbitt stony loams, 35 to 65 percent slopes, on canyonsides along the St. Maries River.

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from basalt with a mantle of loess
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Rapid and very rapid
Hazard of water erosion: Severe

Bobbitt

Setting

Landscape position: South-facing canyonsides and escarpments
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,160 to 3,200 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 47 to 49 degrees F
Frost-free period: 100 to 130 days

Typical Profile

Organic mat—2-inches thick
12 to 32 inches—brown and pale brown very cobbly clay loam
32 inches—hard, fractured basalt bedrock

Soil Properties and Qualities

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from basalt with a mantle of loess
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Very rapid
Hazard of water erosion: Severe

Inclusions

Contrasting inclusions:
- Lacy soils on south-facing canyonsides and ridges
- Dorb soils on north-facing canyonsides and escarpments
- Ahrs soils on lower positions of south-facing slopes
- Areas of rock outcrop on convex areas of canyonsides

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Agatha

Woodland suitability subclass: 6R
Trees suitable for planting: Douglas-fir and grand fir
Mean site index: Grand fir—64 (50-year site curve)
Estimated average annual production (CMAI): Grand fir—83 cubic feet at 117 years of age
Dominant vegetation in potential natural plant community: Grand fir, western white pine, western larch, Douglas-fir, ponderosa pine, lodgepole pine, mallow ninebark, common snowberry, and creambush oceanspray

Bobbitt

Woodland suitability subclass: 9R
Trees suitable for planting: Douglas-fir and Ponderosa pine
Mean site index:
Douglas-fir—71 (50-year site curve)
Ponderosa pine—115 (100-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—63 cubic feet at 102 years of age
Ponderosa pine—130 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Douglas-fir, ponderosa pine, common snowberry, bluebunch wheatgrass, and pine reedgrass

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation on the Agatha soil.
- Reforestation on the Bobbitt soil is difficult on the hotter, drier, south-facing slopes because of droughtiness.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.

- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully to control competing brushy vegetation on the Agatha soil.
- Leave some of the larger trees on the Bobbitt soil to provide shade for seedlings.

Grazeable Understory

Agatha

Common forest understory plants: Baldhip rose, Columbia brome, common snowberry, creambush oceanspray, elk sedge, pine reedgrass, mallow ninebark, strawberry, sweetscented bedstraw, American trailplant, Rocky Mountain maple, and white spirea
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 15 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Bobbitt

Common forest understory plants: Bluebunch wheatgrass, common snowberry, elk sedge, heartleaf arnica, pine reedgrass, rose, spreading sweetroot, strawberry, western fescue, and white spirea
Total production of air-dry vegetation (pounds per acre): 900
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 15 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 900 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Thick brush on the Agatha soil can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs on the Agatha soil by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Excavation increases the risk of water erosion.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Excavation is hampered by the limited depth to bedrock.

Management practices:
- Design and construct access roads to compensate for large stones, steepness of slope, and limited depth to bedrock.
- Preserve the existing plant cover during construction to reduce the risk of erosion.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.

Interpretive Groups

Capability class: VIIe

4—Ahrs gravelly silt loam, 35 to 75 percent slopes

Composition

Ahrs and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: East- and west-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Plane to convex
Elevation: 2,400 to 4,800 feet
Mean annual precipitation: 30 to 42 inches
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 6 inches—grayish brown gravelly silt loam
6 to 18 inches—yellowish brown very cobbly silt loam
18 to 30 inches—light yellowish brown extremely cobbly loam
30 to 60 inches—very pale brown extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock, primarily siltite and argillite, with a mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Pinecreek and Lotuspoint soils on south-facing slopes
- Honeyjones soils on north-facing slopes
- Latour soils on north-facing slopes at higher elevations
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Watershed
- Wildlife habitat

Woodland

Woodland suitability subclass: 8R
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—78 (50-year site curve)
Western white pine—83 (50-year site curve)
Douglas-fir—77 (50-year site curve)
Ponderosa pine—105 (100-year site curve)
Estimated average annual production (CMAI):
Grand fir—110 cubic feet at 108 years of age
Western white pine—160 cubic feet at 100 years of age
Douglas-fir—75 cubic feet at 99 years of age
Ponderosa pine—112 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, ponderosa pine, western white pine, queencup beadlily, goldthread, and myrtle pachystima
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Longtube twinflower, Columbia brome, starry false Solomon's seal, queencup beadlily, goldthread, common snowberry, American trailplant, Piper's anemone, Rocky Mountain maple, myrtle pachystima, baldhip rose, Saskatoon serviceberry, and white spirea
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIIe

5—Ahrs-Pinecreek association, 35 to 75 percent slopes

Composition

Ahrs soil and similar inclusions: 50 percent
Pinecreek soil and similar inclusions: 35 percent
Contrasting inclusions: 15 percent

Ahrs

Setting

Landscape position: East- and west-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Plane to convex
Elevation: 2,200 to 4,800 feet
Mean annual precipitation: 30 to 42 inches
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 6 inches—grayish brown gravelly silt loam
6 to 18 inches—yellowish brown very cobbly silt loam
18 to 30 inches—light yellowish brown extremely cobbly loam
30 to 60 inches—very pale brown extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock, primarily siltite and argillite, with a mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Pinecreek

Setting

Landscape position: South-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Plane to convex
Elevation: 2,200 to 4,000 feet
Mean annual precipitation: 28 to 35 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

Organic mat—1 inch thick
0 to 10 inches—grayish brown and brown gravelly silt loam
10 to 22 inches—yellowish brown gravelly silt loam
22 to 37 inches—light yellowish brown very gravelly silt loam
37 to 60 inches—light yellowish brown extremely cobbly silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Lotuspoint soils on south-facing convex slopes
- Honeyjones soils on north-facing slopes
- Soils on south-facing convex slopes and ridges that have hard bedrock at a depth of less than 20 inches
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Watershed
- Wildlife habitat

Woodland

Ahrs

Woodland suitability subclass: 8R
Trees suitable for planting: Douglas-fir and grand fir
Mean site index:
Douglas-fir—77 (50-year site curve)
Grand fir—78 (50-year site curve)
Ponderosa pine—105 (100-year site curve)
Western white pine—83 (50-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—75 cubic feet at 99 years of age
Grand fir—110 cubic feet at 108 years of age
Western white pine—160 cubic feet at 100 years of age
Ponderosa pine—112 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, ponderosa pine, western white pine, queencup beadlily, American trailplant, goldthread, and myrtle pachystima

Pinecreek

Woodland suitability subclass: 7R
Trees suitable for planting: Douglas-fir and ponderosa pine
Mean site index:
Douglas-fir—72 (50-year site curve)
Ponderosa pine—102 (100-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—65 cubic feet at 102 years of age
Ponderosa pine—106 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Douglas-fir, ponderosa pine, mallow ninebark, common snowberry, creambush oceanspray, and pine reedgrass

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Reforestation on the Pinecreek soil is difficult on the hotter, drier, south-facing slopes because of droughtiness.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully to control competing brushy vegetation.
- Leave some of the larger trees on the Pinecreek soil to provide shade for seedlings.

Grazeable Understory

Ahrs

Common forest understory plants: Columbia brome, starry false Solomon's seal, queencup beadlily, American trailplant, goldthread, common snowberry, longtube twinflower, Piper's anemone, Rocky Mountain maple, myrtle pachystima, baldhip rose, Saskatoon serviceberry, and white spirea
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Pinecreek

Common forest understory plants: Pine reedgrass, elk sedge, mallow ninebark, common snowberry, baldhip rose, creambush oceanspray, Columbia brome, strawberry, heartleaf arnica, conspicuous aster, white spirea, and low Oregongrape
Total production of air-dry vegetation (pounds per acre): 850
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 15 to 25 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production

ranges from 1,800 pounds of air-dry forage per acre to less than 850 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIIe

6—Aquic Udifluvents, 0 to 4 percent slopes

Composition

Aquic Udifluvents: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Flood plains and low stream terraces
Slope range: 0 to 4 percent
Slope features: Plane to convex
Elevation: 2,135 to 3,300 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Pedon

0 to 6 inches—very pale brown and yellowish brown silt loam
6 to 60 inches—stratified, variegated silt loam to extremely cobbly coarse sand

Soil Properties and Qualities

Depth class: Moderately deep to sand, gravel, and cobbles
Drainage class: Somewhat poorly drained
Parent material: Mixed alluvium derived from metasedimentary rocks mixed with slickens and mine tailings in some areas
Permeability: Moderate or moderately rapid in the upper part and moderate to very rapid below
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 18 to 30 inches—February through May; 30 to greater than 60 inches—Rest of year
Hazard of flooding: Occasional: Brief—February through May

Inclusions

Contrasting inclusions:
- Ramsdell and Bellslake soils on lower, very poorly drained areas of flood plains
- Pokey soils on intermediate positions of flood plains and low stream terraces
- Miesen soils on higher positions of flood plains and low stream terraces
- Typic Fluvaquents on very poorly drained positions in meander channels on flood plains

Use and Management

Major current uses:
- Livestock grazing
- Timber production
- Recreation
- Hayland
- Pastureland
- Wildlife habitat
- Homesites

Pastureland

- This unit is suited to nonirrigated pasture with some limitations. A high level of management should be used to obtain suitable yields of adapted grasses

and legumes. Some of the adapted forage plants are orchardgrass, smooth brome, tall fescue, meadow foxtail, timothy, and clover.

Management limitations:

- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Providing drainage is difficult because most areas have poor outlets and are seasonally flooded.

Management practices:

- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Seed only forage plants that tolerate periodic inundation and seasonal wetness.
- Use open ditches or tile drains to remove water on or near the surface.
- Provide water control structures to reduce the risk of flooding.

Woodland

Woodland suitability subclass: 8W

Trees suitable for planting: Grand fir, Douglas-fir, and western white pine

Mean site index: Grand fir—78 (50-year site curve)

Estimated average annual production (CMAI): Grand fir—110 cubic feet at 108 years of age

Dominant vegetation in potential natural plant community: Western red cedar, grand fir, black cottonwood, common ladyfern, longtube twinflower, and sedge

Management limitations:

- The seasonal high water table restricts the use of equipment.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:

- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- Prepare the site carefully to control competing vegetation.

Grazeable Understory

Common forest understory plants: Scouler's willow, western river alder, fivestamen miterwort, western thimbleberry, big blueberry, longtube twinflower, pyrola, sedge, Sitka alder, black hawthorn, and common ladyfern

Total production of air-dry vegetation (pounds per acre): 200

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:

- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:

- Manage trees and shrubs by clearing or thinning to create open areas for forage production.
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:

- Seasonal flooding and wetness restrict building site and recreational development.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and flooding.
- The risk of seepage and the hazard of polluting the water supply limit the use of this unit as a septic tank absorption field.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Cutbanks can cave because of the sandy substratum.

Management practices:

- Reduce wetness by providing suitably designed drainage ditches or tile drains.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Susceptibility of the soil to slumping and piping when saturated requires special design of water retention structures.
- Design and construct buildings and roads to compensate for frost action, seasonal wetness, and flooding.

- Design and construct septic tank absorption fields to compensate for seasonal wetness, flooding, and hazard of seepage.
- Excavations should be designed to prevent cutbanks from caving.
- Design and construct roads and trails to compensate for large stones.

Interpretive Groups

Capability class: IVw

7—Aquic Udifluvents, protected, 0 to 4 percent slopes

Composition

Aquic Udifluvents, protected: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Flood plains and low stream terraces
Slope range: 0 to 4 percent
Slope features: Plane to convex
Elevation: 2,200 to 3,300 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 6 inches—brown and grayish brown silt loam
6 to 60 inches—stratified, variegated silt loam to extremely cobbly coarse sand

Soil Properties and Qualities

Depth class: Moderately deep to sand, gravel, and cobbles
Drainage class: Somewhat poorly drained
Parent material: Mixed alluvium derived from metasedimentary rocks mixed with slickens and mine tailings in some areas
Permeability: Moderate in the upper part and moderate to very rapid below
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 18 to 30 inches—February through May; 30 to more than 60 inches—Rest of year
Hazard of flooding: Rare: Protected by levees

Inclusions

Contrasting inclusions:
- Udarents on disturbed and fill areas
- Somewhat poorly drained soils similar to Helmer soils on adjacent low terraces
- Well-drained soils similar to Aquic Udifluvents, protected, on higher convex areas of valley floors

Use and Management

Major current uses:
- Homesites
- Recreation
- Wildlife habitat
- Urban development

Building Site and Recreational Development

Management limitations:
- Rare flooding can be a hazard if levees fail.
- Rare flooding restricts building site and recreational development.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Embankments are subject to piping and slumping when saturated.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness.
- The risk of seepage and the hazard of polluting the water supply limit the use of this unit as a septic tank absorption field.
- Cutbanks can cave because of the sandy substratum.

Management practices:
- Reduce wetness by providing suitably designed drainage ditches or tile drains.
- Reduce the risk of flooding by maintaining levees that have outlets for floodwater.
- Susceptibility of the soil to slumping and piping when saturated requires special design of water retention structures.
- Design and construct roads to compensate for frost action and cobbles.
- Design and construct sewage disposal systems to compensate for hazard of seepage, wetness, and cobbles.
- Excavations should be designed to prevent cutbanks from caving.
- Design and construct buildings to compensate for wetness and the possibility of rare flooding if the levees fail.

- Stabilize embankments to prevent piping and slumping when saturated.

Interpretive Groups

Capability class: IVs

8—Bechtel-Reggear silt loams, 20 to 40 percent slopes

Composition

Bechtel and similar soils: 50 percent
Reggear and similar soils: 35 percent
Contrasting inclusions: 15 percent

Bechtel

Setting

Landscape position: South-facing foothills
Slope range: 20 to 40 percent
Slope features: Convex
Elevation: 2,800 to 3,400 feet
Mean annual precipitation: 35 to 40 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—0.5-inch thick
0 to 12 inches—pale brown and very pale brown silt loam
12 to 33 inches—very pale brown gravelly loam
33 to 47 inches—mixed very pale brown and pale yellow very gravelly loam
47 inches—soft weathered siltstone

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from sedimentary siltstone and shale with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: Moderate
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Rapid
Hazard of water erosion: Severe to very severe

Reggear

Setting

Landscape position: South-facing toeslopes and dissected terraces
Slope range: 20 to 30 percent
Slope features: Concave to convex
Elevation: 2,800 to 3,400 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 11 inches—grayish brown, brown, and yellowish brown silt loam
11 to 18 inches—light yellowish brown silt loam
18 to 24 inches—mixed light yellowish brown and very pale brown silt loam
24 to 60 inches—mixed light brown and very pale brown dense silty clay loam

Soil Properties and Qualities

Depth class: Moderately deep to a fragipan
Drainage class: Moderately well drained
Parent material: Loess deposits with minor amounts of volcanic ash
Permeability: Very slow
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Rapid
Hazard of water erosion: Severe
Depth to perched water table: 18 to 36 inches—February to April

Inclusions

Contrasting inclusions:
- Helmer soils on north- and east-facing toeslopes and dissected terraces
- Ahrs soils on south- and west-facing convex slopes at higher elevations
- Hobo soils on north- and east-facing terrace slopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Homesites

Woodland

Bechtel

Woodland suitability subclass: 8A
Trees suitable for planting: Douglas-fir and ponderosa pine
Mean site index:
Grand fir—78 (50-year site curve)
Douglas-fir—81 (50-year site curve)

Estimated average annual production (CMAI):
Grand fir—110 cubic feet at 108 years of age
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western white pine, ponderosa pine, western larch, lodgepole pine, queencup beadlily, myrtle pachystima, and longtube twinflower

Reggear

Woodland suitability subclass: 6D
Trees suitable for planting: Douglas-fir and ponderosa pine
Mean site index:
Grand fir—68 (50-year site curve)
Douglas-fir—69 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—91 cubic feet at 114 years of age
Douglas-fir—59 cubic feet at 104 years of age

Management limitations:
- Slope in steeper areas limits the kinds of equipment that can be used in forest management.
- The seasonal perched water table in Reggear soil restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable on the Reggear soil. They may be impassable during rainy periods.
- During periods of heavy rainfall and snowmelt, the perched water table in the Reggear soil is high for a period of time. Trees commonly are subject to windthrow because the soil is saturated during these periods, and roots are limited by the cemented and compacted layer in the soil.
- Road cutbanks on the Reggear soil are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use harvesting equipment only during dry periods because the Reggear soil is unsuited to traffic when wet.
- Logging roads on the Reggear soil require suitable surfacing and a stable base for use during wet periods.
- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Roads and skid trails on the Reggear soil should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.

Grazeable Understory

Common forest understory plants: Columbia brome, longtube twinflower, queencup beadlily, goldthread, American trailplant, Piper's anemone, starry false Solomon's seal, Rocky Mountain maple, myrtle pachystima, common snowberry, baldhip rose, Saskatoon serviceberry, and white spirea
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- Forage for livestock and big game animals can be produced for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,600 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of the steeper areas of this unit for site development.
- Slope in some areas may limit the use of construction equipment.
- Excavation increases the risk of water erosion.
- Septic tank absorption fields can be expected to function poorly on the Bechtel soil because of the limited depth to bedrock.
- Unsurfaced access roads on the Reggear soil are subject to rilling and gullying.
- Road cutbanks are subject to slumping on the Reggear soil.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength on the Reggear soil.
- Septic tank absorption fields can be expected to function poorly on the Reggear soil because of seasonal wetness and the restricted permeability of the soil.

Management practices:
- Design and construct buildings and roads to compensate for slope, seasonal wetness, low soil strength, and frost action on the Reggear soil.
- Preserve the existing plant cover during construction to reduce the risk of erosion.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Road surfaces on the Reggear soil should be graveled and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Design and construct septic tank absorption fields to compensate for slope, seasonal wetness, and restricted soil permeability on the Reggear soil.
- Construct roads for year-round use with heavy base rock on the Reggear soil.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability on the Reggear soil when wet.
- Stabilize cutbanks on the Reggear soil to avoid slumping onto the roadway.

Interpretive Groups

Capability class: VIe

9—Bellslake silt loam, 0 to 1 percent slopes

Composition

Bellslake and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Depressions on flood plains
Slope range: 0 to 1 percent
Slope features: Concave
Elevation: 2,120 to 2,140 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 9 inches—mottled grayish brown silt loam
9 to 38 inches—mottled grayish brown, light gray, and brown silt loam and mucky silt loam
38 to 42 inches—mottled very dark brown highly decomposed organic material
42 to 60 inches—dark gray moderately decomposed organic material

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium and organic material derived from mixed sources
Permeability: Moderate
Available water capacity: Very high
Potential rooting depth: 60 inches or more
Rate of surface runoff: Ponded
Hazard of water erosion: None
Depth to seasonal high water table: +12 to 18 inches—October to August; 18 to 36 inches—Rest of year
Hazard of flooding: Frequent: Very long—December to June

Inclusions

Contrasting inclusions:
- Ramsdell soils on lower positions of flood plains
- Mazie soils on lower positions of flood plains
- Miesen soils on higher positions of flood plains
- Soils that are organic throughout on lowest positions of flood plains

Use and Management

Major current uses:
- Hayland
- Pastureland
- Wetland wildlife habitat
- Recreation

Hayland and Pastureland

- Adapted improved forage plants are timothy, meadow foxtail, reed canarygrass, tall fescue, and alsike clover.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer and poor tilth.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Providing drainage is difficult because most areas have poor outlets and are seasonally flooded and ponded.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Seed only the forage plants that tolerate periodic inundation and seasonal wetness.
- Use open ditches or tile drains to remove water on or near the surface.
- Provide water control structures to reduce the risk of flooding.

Woodland

- This soil does not produce merchantable timber because of inundation and flooding.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding, ponding, and wetness restrict building site and recreational development.
- The quality of roadbeds and road surfaces can be adversely affected by shrinking and swelling, subsidence, frost action, and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of wetness.
- Embankments are subject to piping and slumping when saturated.

Management practices:
- Design and construct buildings and roads to compensate for flooding, ponding, wetness, subsidence, load-supporting capacity, and frost action.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Provide a stable base and adequate wearing surface to improve trafficability of roads when wet.
- Construct roads with heavy base rock for year-round use.
- Reduce wetness by providing suitably designed drainage ditches or tile drainage systems.
- Stabilize embankments to prevent piping and slumping when saturated.

Interpretive Groups

Capability class: Vw

10—Blackprince-Rock outcrop complex, 35 to 75 percent slopes

Composition

Blackprince and similar soils: 55 percent
Rock outcrop: 25 percent
Contrasting inclusions: 20 percent

Blackprince

Setting

Landscape position: East- and west-facing slopes of foothills and canyonsides
Slope range: 35 to 75 percent
Slope features: Convex
Elevation: 2,200 to 3,600 feet
Mean annual precipitation: 30 to 38 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown gravelly sandy loam
3 to 11 inches—pale brown gravelly sandy loam
11 to 22 inches—very pale brown very gravelly coarse sandy loam
22 to 28 inches—variegated very gravelly loamy coarse sand
28 inches—weathered granitic bedrock

Soil Properties and Qualities

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Parent material: Weathered material derived from gneiss or granitic bedrock with minor amounts of loess and volcanic ash in the upper part
Permeability: Moderately rapid in the upper part and rapid below to soft bedrock
Available water capacity: Very low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Severe gully erosion

Rock outcrop

Setting

Landscape position: Canyonsides and ridges
- Rock outcrop consists of areas of exposed granitic bedrock.
- Areas of rock outcrop are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Kruse soils on concave east- and west-facing slopes
- Lotuspoint soils on south-facing slopes
- Soils with soft bedrock at depths of less than 20 inches on south-facing convex slopes and ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 7R
Trees suitable for planting: Douglas-fir and ponderosa pine

Mean site index:
Grand fir—73 (50-year site curve)
Douglas-fir—74 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—100 cubic feet at 111 years
Douglas-fir—69 cubic feet at 101 years of age
- Areas of rock outcrop reduce yield about 25 percent.

Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, ponderosa pine, mallow ninebark, creambush oceanspray, and common snowberry
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Areas of rock outcrop can interfere with logging and yarding operations and may cause breakage of timber.
- Seedling mortality may be high in summer because of the lack of adequate soil moisture.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Leave some of the larger trees to provide shade for seedlings.
- Prepare the site carefully to control competing brushy vegetation.
- Adequately designed road drainage reduces the risk of gully erosion on the roadway.

Grazeable Understory

Common forest understory plants: Mallow ninebark, common snowberry, Columbia brome, creambush oceanspray, baldhip rose, white spirea, elk sedge, pine reedgrass, strawberry, sweetscented bedstraw, American trailplant, and Rocky Mountain maple
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- The production of forage is limited by the areas of rock outcrop, which generally interfere with the movement of livestock and limit the accessibility of forage.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Areas of rock outcrop in some areas may interfere with the use of construction equipment.
- The deep cuts needed to level the road surface can expose soft bedrock; however, it can be easily excavated.
- Unsurfaced access roads are subject to rilling and gullying.

Management practices:
- Design and build structures and roads to compensate for the steepness of slope and areas of rock outcrop.
- Design access roads to control surface runoff on the roadway.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class:
Blackprince soil—VIIe
Rock outcrop—VIIIs

11—Blackprince, warm-Rock outcrop complex, 35 to 65 percent slopes

Composition

Blackprince, warm and similar soils: 60 percent
Rock outcrop: 20 percent
Contrasting inclusions: 20 percent

Blackprince, warm

Setting

Landscape position: South-facing slopes of foothills and canyonsides
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,200 to 3,400 feet
Mean annual precipitation: 30 to 34 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 100 to 120 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown gravelly sandy loam
3 to 11 inches—pale brown gravelly sandy loam
11 to 22 inches—very pale brown very gravelly coarse sandy loam
22 to 28 inches—variegated very gravelly loamy coarse sand
28 inches—weathered granitic bedrock

Soil Properties and Qualities

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Parent material: Weathered material derived from gneiss or granitic bedrock with minor amounts of loess and volcanic ash in the upper part
Permeability: Moderately rapid in the upper part and rapid below to soft bedrock
Available water capacity: Very low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Severe gully erosion

Rock outcrop

Setting

Landscape position: Canyonsides and ridges
- Rock outcrop consists of areas of exposed granitic bedrock.
- Areas of rock outcrop are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Lotuspoint soils on south-facing ridges
- Kruse soils on concave east- and west-facing slopes
- Soils with soft bedrock at depths of less than 20 inches on south-facing convex slopes and ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Homesites

Woodland

Woodland suitability subclass: 8R
Trees suitable for planting: Ponderosa pine
Mean site index:
Douglas-fir—71 (50-year site curve)
Ponderosa pine—105 (100-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—63 cubic feet at 102 years of age
Ponderosa pine—112 cubic feet at 40 years of age
- Areas of rock outcrop reduce yield about 20 percent.

Dominant vegetation in potential natural plant community: Douglas-fir, ponderosa pine, mallow ninebark, common snowberry, and pine reedgrass
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Areas of rock outcrop can interfere with logging and yarding operations and may cause breakage of timber.
- Reforestation is difficult on the hotter, drier, south-facing slopes because of droughtiness.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Adequately designed road drainage reduces the risk of gully erosion on the roadway.
- Leave some of the larger trees to provide shade for seedlings.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Mallow ninebark, low Oregongrape, common snowberry, elk sedge, Columbia brome, strawberry, heartleaf arnica, conspicuous aster, creambush oceanspray, white spirea, pine reedgrass, and baldhip rose

Total production of air-dry vegetation (pounds per acre): 850
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 15 to 25 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 850 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- The production of forage is limited by the areas of rock outcrop, which generally interfere with the movement of livestock and limit the accessibility of forage.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Areas of rock outcrop in some areas may interfere with the use of construction equipment.
- Unsurfaced access roads are subject to rilling and gullying.
- The deep cuts needed to level the road surface can expose soft bedrock; however, it can be easily excavated.
- The risk of seepage when using hazardous materials could affect the water quality of nearby streams.

Management practices:
- Design and construct buildings and access roads to compensate for the steepness of slope and areas of rock outcrop.
- Design access roads to control surface runoff on the roadway.
- Preserve water quality by avoiding the use of hazardous materials near streams.

Interpretive Groups

Capability class:
Blackprince, warm—VIIe
Rock outcrop—VIIIs

12—Bouldercreek silt loam, 35 to 65 percent slopes

Composition

Bouldercreek and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Plane to convex
Elevation: 2,600 to 5,000 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—2.5-inches thick
0 to 2 inches—pale brown silt loam
2 to 15 inches—light yellowish brown silt loam
15 to 26 inches—light yellowish brown very gravelly loam
26 to 60 inches—mixed very pale brown and pink extremely gravelly sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Marblecreek soils on south-facing mountain slopes
- Flewsie soils on foothills at lower elevations
- Nakarna soils on east- and west-facing mountain slopes
- Soils similar to Bouldercreek soils with bedrock at less than 60 inches on ridges and convex slopes
- Areas of rock outcrop on convex areas of mountain slopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing

- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—89 (50-year site curve)
Western white pine—96 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Western larch—65 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—131 cubic feet at 97 years of age
Western white pine—186 cubic feet at 90 years of age
Douglas-fir—81 cubic feet at 97 years of age
Western larch—91 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, grand fir, western larch, Douglas-fir, western white pine, lodgepole pine, wild ginger, queencup beadlily, goldthread, and oneleaf foamflower
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively in harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.

Grazeable Understory

Common forest understory plants: Starry false Solomon's seal, American trailplant, Columbia brome, goldthread, Oregon fairybells, oneleaf foamflower, queencup beadlily, violet, western rattlesnake plantain, and wild ginger
Total production of air-dry vegetation (pounds per acre): 100
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads to compensate for the steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

13—Bouldercreek silt loam, high precipitation, 35 to 75 percent slopes

Composition

Bouldercreek and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Plane to convex
Elevation: 2,600 to 4,800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 42 to 44 degrees F

Frost-free period: 60 to 90 days

Typical Profile

Organic mat—2.5-inches thick
0 to 2 inches—pale brown silt loam
2 to 15 inches—light yellowish brown silt loam
15 to 26 inches—light yellowish brown very gravelly loam
26 to 60 inches—mixed very pale brown and pink extremely gravelly sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Marblecreek soils on south-facing mountain slopes
- Flewsie, high precipitation soils on foothills
- Nakarna, high precipitation soils on east- and west-facing slopes of foothills and mountains
- Hugus, high precipitation soils on north-facing footslopes
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir, western white pine, and Douglas-fir
Mean site index:
Grand fir—89 (50-year site curve)
Western white pine—96 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Western larch—65 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—131 cubic feet at 97 years of age
Western white pine—186 cubic feet at 90 years of age
Douglas-fir—81 cubic feet at 97 years
Western larch—91 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, grand fir, western larch, Douglas-fir, western white pine, wild ginger, queencup beadlily, longtube twinflower, goldthread, and Rocky Mountain maple
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.

Grazeable Understory

Common forest understory plants: Starry false Solomon's seal, American trailplant, Columbia brome, goldthread, Oregon fairybells, longtube twinflower, Rocky Mountain maple, queencup beadlily, violet, western rattlesnake plantain, and wild ginger
Total production of air-dry vegetation (pounds per acre): 100
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

14—Bouldercreek-Marblecreek association, 15 to 35 percent slopes

Composition

Bouldercreek and similar soils: 45 percent
Marblecreek and similar soils: 35 percent
Contrasting inclusions: 20 percent

Bouldercreek

Setting

Landscape position: North-facing mountain slopes and ridges
Slope range: 15 to 35 percent
Slope features: Convex
Elevation: 2,600 to 4,400 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—2.5-inches thick
0 to 2 inches—pale brown silt loam
2 to 15 inches—light yellowish brown silt loam
15 to 26 inches—light yellowish brown very gravelly loam
26 to 60 inches—mixed very pale brown and pink extremely gravelly sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium
Hazard of water erosion: Slight

Marblecreek

Setting

Landscape position: South-facing mountain slopes and ridges
Slope range: 15 to 35 percent
Slope features: Convex
Elevation: 2,600 to 4,400 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown gravelly silt loam
3 to 11 inches—light yellowish brown gravelly silt loam
11 to 25 inches—very pale brown very gravelly sandy loam
25 to 44 inches—pink extremely gravelly sandy loam
44 to 60 inches—pink extremely cobbly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium
Hazard of water erosion: Slight

Inclusions

Contrasting inclusions:
- Nakarna soils on north-facing slopes

- Soils similar to Marblecreek soils on south-facing convex slopes that have bedrock at depths of 40 to 60 inches
- Kruse soils on east- and west-facing concave slopes
- Flewsie soils on foothills at lower elevations
- Areas of rock outcrop on convex areas of ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Bouldercreek

Woodland suitability subclass: 9A
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index for stated species:
Grand fir—89 (50-year site curve)
Western larch—65 (50-year site curve)
Western white pine—96 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—131 cubic feet at 97 years of age
Western larch—91 cubic feet at 70 years of age
Western white pine—186 cubic feet at 90 years of age
Douglas-fir—81 cubic feet at 97 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, grand fir, western larch, western white pine, Douglas-fir, lodgepole pine, wild ginger, queencup beadlily, goldthread, and oneleaf foamflower

Marblecreek

Woodland suitability subclass: 10F
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—97 (50-year site curve)
Douglas-fir—79 (50-year site curve)
Western larch—72 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—147 cubic feet at 91 years of age
Douglas-fir—79 cubic feet at 98 years of age
Western larch—105 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, ponderosa pine, western white pine, queencup beadlily, myrtle pachystima, common snowberry, longtube twinflower, and goldthread
Management limitations:
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- Road cutbanks on the Marblecreek soil are occasionally subject to caving.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation on the Marblecreek soil.

Management practices:
- Stabilize road cutbanks on the Marblecreek soil to avoid the hazard of caving.
- Prepare the site carefully on the Marblecreek soil to control competing brushy vegetation.

Grazeable Understory

Bouldercreek

Common forest understory plants: Starry false Solomon's seal, American trailplant, Columbia brome, goldthread, Oregon fairybells, oneleaf foamflower, queencup beadlily, violet, western rattlesnake plantain, and wild ginger
Total production of air-dry vegetation (pounds per acre): 100
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Marblecreek

Common forest understory plants: Myrtle pachystima, queencup beadlily, common snowberry, Piper's anemone, starry false Solomon's seal, Rocky Mountain maple, baldhip rose, Saskatoon serviceberry, white spirea, longtube twinflower, goldthread, Columbia brome, and American trailplant
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Thick brush can invade on the Marblecreek soil when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Manage trees and shrubs on the Marblecreek soil by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- The quality of roadbeds and road surfaces on the Bouldercreek soil can be adversely affected by frost action.
- Cutbanks can cave on the Marblecreek soil because of the sandy substratum.
- The hazard of seepage may cause contamination of nearby streams from sanitary facilities.

Management practices:
- Design and construct buildings, roads, and camp areas to compensate for slope.
- Design and construct roads to compensate for large stones.
- Design and construct buildings and roads on the Bouldercreek soil to compensate for frost action.
- Excavations on the Marblecreek soil should be designed to prevent cutbanks from caving.
- Design and construct sanitary facilities to compensate for the hazard of seepage.

Interpretive Groups

Capability class: VIe

15—Bouldercreek-Marblecreek association, 35 to 65 percent slopes

Composition

Bouldercreek and similar soils: 45 percent
Marblecreek and similar soils: 35 percent
Contrasting inclusions: 20 percent

Bouldercreek

Setting

Landscape position: North-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Concave to convex
Elevation: 2,600 to 4,800 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—2.5-inches thick
0 to 2 inches—pale brown silt loam
2 to 15 inches—light yellowish brown silt loam
15 to 26 inches—light yellowish brown very gravelly loam
26 to 60 inches—mixed very pale brown and pink extremely gravelly sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Marblecreek

Setting

Landscape position: South-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,600 to 5,000 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown gravelly silt loam
3 to 11 inches—light yellowish brown gravelly silt loam
11 to 25 inches—very pale brown very gravelly sandy loam
25 to 44 inches—pink extremely gravelly sandy loam
44 to 60 inches—pink extremely cobbly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a mantle of volcanic ash

Permeability: Moderate in the upper part and rapid below
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Soils similar to Marblecreek soils on south-facing convex slopes that have bedrock at depths of 40 to 60 inches
- Nakarna soils on north-facing slopes
- Flewsie soils on foothills at lower elevations
- Areas of rock outcrop
- Rubble land

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Bouldercreek

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—89 (50-year site curve)
Western white pine—96 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Western larch—65 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—131 cubic feet at 97 years of age
Western white pine—186 cubic feet at 90 years of age
Douglas-fir—81 cubic feet at 97 years of age
Western larch—91 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, grand fir, western white pine, western larch, Douglas-fir, lodgepole pine, wild ginger, queencup beadlily, goldthread, and oneleaf foamflower

Marblecreek

Woodland suitability subclass: 10R
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—97 (50-year site curve)
Douglas-fir—79 (50-year site curve)
Western larch—72 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—147 cubic feet at 91 years of age
Douglas-fir—79 cubic feet at 98 years of age
Western larch—105 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, ponderosa pine, western white pine, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation on the Marblecreek soil.
- Road cutbanks on the Marblecreek soil are occasionally subject to caving.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully on the Marblecreek soil to control competing brushy vegetation.
- Stabilize road cutbanks on the Marblecreek soil to avoid the hazard of caving.

Grazeable Understory

Bouldercreek

Common forest understory plants: Starry false Solomon's seal, American trailplant, Columbia brome, goldthread, Oregon fairybells, oneleaf foamflower, queencup beadlily, violet, western rattlesnake plantain, and wild ginger.
Total production of air-dry vegetation (pounds per acre): 100
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production

ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Marblecreek

Common forest understory plants: Starry false Solomon's seal, Rocky Mountain maple, baldhip rose, Saskatoon serviceberry, white spirea, myrtle pachystima, queencup beadlily, common snowberry, longtube twinflower, Piper's anemone, goldthread, Columbia brome, and American trailplant
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Thick brush on the Marblecreek soil can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs on the Marblecreek soil by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Road cutbanks on the Marblecreek soil are subject to caving.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Excavations should be designed to prevent cutbanks from caving on the Marblecreek soil.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

16—Bouldercreek, high precipitation-Marblecreek association, 35 to 65 percent slopes

Composition

Bouldercreek and similar soils: 50 percent
Marblecreek and similar soils: 30 percent
Contrasting inclusions: 20 percent

Bouldercreek, high precipitation

Setting

Landscape position: North-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Concave to convex
Elevation: 2,600 to 4,800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—2.5-inches thick
0 to 2 inches—pale brown silt loam
2 to 15 inches—light yellowish brown silt loam
15 to 26 inches—light yellowish brown very gravelly loam
26 to 60 inches—mixed very pale brown and pink extremely gravelly sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below
Available water capacity: Low
Potential rooting depth: More than 60 inches

Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Marblecreek

Setting

Landscape position: South-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,600 to 5,000 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown gravelly silt loam
3 to 11 inches—light yellowish brown gravelly silt loam
11 to 25 inches—very pale brown very gravelly sandy loam
25 to 44 inches—pink extremely gravelly sandy loam
44 to 60 inches—pink extremely cobbly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Low
Potential rooting depth: More than 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Nakarna, high precipitation soils on north-facing slopes
- Flewsie, high precipitation soils on foothills
- Areas of rock outcrop
- Rubble land

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Bouldercreek, high precipitation

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir, western white pine, and Douglas-fir
Mean site index:
Grand fir—89 (50-year site curve)
Western white pine—96 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Western larch—65 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—131 cubic feet at 97 years of age
Western white pine—186 cubic feet at 90 years of age
Douglas-fir—81 cubic feet at 97 years of age
Western larch—91 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, grand fir, western white pine, western larch, Douglas-fir, wild ginger, queencup beadlily, longtube twinflower, goldthread, and Rocky Mountain maple

Marblecreek

Woodland suitability subclass: 10R
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—97 (50-year site curve)
Douglas-fir—79 (50-year site curve)
Western larch—72 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—147 cubic feet at 91 years of age
Douglas-fir—79 cubic feet at 98 years of age
Western larch—105 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, ponderosa pine, western white pine, queencup beadlily, myrtle pachystima, common snowberry, longtube twinflower, and goldthread

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Road cutbanks are occasionally subject to caving on the Marblecreek soil.

- When openings are made in the canopy, invading brushy plants can delay natural reforestation on the Marblecreek soil.

Management practices:

- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Stabilize road cutbanks on the Marblecreek soil to avoid the hazard of caving.
- Prepare the site carefully to control competing brushy vegetation on the Marblecreek soil.

Grazeable Understory

Bouldercreek, high precipitation

Common forest understory plants: Starry false Solomon's seal, American trailplant, Columbia brome, goldthread, Oregon fairybells, longtube twinflower, Rocky Mountain maple, queencup beadlily, violet, western rattlesnake plantain, and wild ginger

Total production of air-dry vegetation (pounds per acre): 100

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Marblecreek soil

C*ommon forest understory plants:* Starry false Solomon's seal, Rocky Mountain maple, baldhip rose, Saskatoon serviceberry, white spirea, myrtle pachystima, queencup beadlily, common snowberry, longtube twinflower, Piper's anemone, goldthread, Columbia brome, and American trailplant

Total production of air-dry vegetation (pounds per acre): 250

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:

- Slope may cause livestock distribution problems.
- Thick brush on the Marblecreek soil can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs on the Marblecreek soil by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Road cutbanks are subject to caving on the Marblecreek soil.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.

Management practices:

- Design and construct roads and trails to compensate for the steepness of slope.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Design and construct roads and trails to compensate for large stones.
- Excavations should be designed to prevent cutbanks from caving on the Marblecreek soil.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

17—Clarkia silt loam, 0 to 2 percent slopes

Composition

Clarkia and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Flood plains, drainageways, and low stream terraces
Slope range: 0 to 2 percent
Slope features: Concave
Elevation: 2,700 to 3,200 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 110 days

Typical Profile

0 to 8 inches—grayish brown silt loam
8 to 15 inches—light yellowish brown silt loam
15 to 32 inches—mottled very pale brown and pale yellow silty clay loam and silt loam
32 to 60 inches—mottled pale yellow and light gray silt loam and silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Alluvium derived from mixed sources
Permeability: Moderately slow
Available water capacity: Very high
Potential rooting depth: 60 inches or more
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 18 to 24 inches—February through June; 24 to more than 60 inches—Rest of year
Hazard of flooding: Frequent: Brief—February to May

Inclusions

Contrasting inclusions:
- Pokey soils on flood plains and low stream terraces along meander points of streams
- Mazie soils on lower positions of flood plains
- Helmer soils on higher terraces

Use and Management

Major current uses:
- Hayland
- Pastureland (fig. 9)
- Recreation
- Wildlife habitat

Hayland and Pastureland

- Adapted improved forage plants are timothy, orchardgrass, tall fescue, smooth brome, clover, reed canarygrass.

Management limitations:
- Wetness limits the choice of plants and the period of cutting or grazing, and increases the risk of winterkill.
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and lower forage production.
- Providing drainage is difficult because most areas are seasonally flooded.

Management practices:
- Seed only forage plants that tolerate periodic inundation and seasonal wetness.
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Use open ditches or tile drains to remove water on or near the surface.
- Provide water control structures to reduce the risk of flooding.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding and wetness restrict building site and recreational development.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and flooding.

Management practices:
- Design and construct buildings and roads to compensate for flooding, seasonal wetness, low soil strength, and frost action.
- Reduce wetness by providing suitably designed drainage ditches or tile drains.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Construct roads with heavy base rock for year-round use.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.

Interpretive Groups

Capability class: Vw

18—Daveggio silt loam, 15 to 35 percent slopes

Composition

Daveggio and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing mountain ridges

Figure 9.—An area of Clarkia silt loam, 0 to 2 percent slopes, used for pasture. Nakarna silt loam, 35 to 65 percent slopes, is on the foothills in the background.

Slope range: 15 to 35 percent
Slope features: Convex to concave
Elevation: 4,800 to 5,500 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—1.75-inches thick
0 to 9 inches—grayish brown silt loam
9 to 21 inches—brown and pale brown silt loam
21 to 41 inches—light yellowish brown and very pale brown loam
41 to 50 inches—very pale brown gravelly sandy loam
50 inches—highly weathered soft micaceous schist

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from micaceous schist with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below to soft bedrock
Available water capacity: Moderate
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium

Hazard of water erosion: Slight in surface layers and severe in subsoil

Inclusions

Contrasting inclusions:
- Vaywood soils on north-facing convex slopes
- Latour soils on steeper north-facing convex slopes
- Bouldercreek soils on mountain slopes at lower elevations
- Nakarna soils on mountain slopes at lower elevations

Use and Management

Major current uses:
- Timber production
- Wildlife habitat
- Recreation
- Watershed

Potential uses:
- Livestock grazing

Woodland

Woodland suitability subclass: 7A
Trees suitable for planting: Subalpine fir and Engelmann spruce
Mean site index:
Subalpine fir—94 (100-year site curve)
Grand fir—78 (50-year site curve)
Engelmann spruce—88 (100-year site curve)
Estimated average annual production (CMAI):
Subalpine fir—96 cubic feet at 90 years of age
Grand fir—110 cubic feet at 108 years of age
Engelmann spruce—88 cubic feet at 90 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, grand fir, Douglas-fir, western larch, Engelmann spruce, rustyleaf menziesia, big blueberry, common beargrass, and queencup beadlily. Some areas also have mountain hemlock.
Management limitations:
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use conventional equipment in harvesting timber.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Rustyleaf menziesia, common beargrass, big blueberry, Utah honeysuckle, western rattlesnake plantain, darkwoods violet, sidebells shinleaf, common prince's pine, myrtle pachystima, Piper's anemone, and queencup beadlily
Total production of air-dry vegetation (pounds per acre): 400
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,200 pounds of air-dry forage per acre to less than 400 pounds per acre as the canopy closes.

Management limitations:
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are slippery when wet.
- Road cutbanks are subject to erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.

Management practices:
- Design and construct roads, trails, and camp areas to compensate for slope.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design and build structures and roads to compensate for frost action.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.

- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIe

19—Dorb stony silt loam, 35 to 65 percent slopes

Composition

Dorb and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing canyonsides and escarpments
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,200 to 3,200 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2.5-inches thick
0 to 3 inches—yellowish brown stony silt loam
3 to 13 inches—light yellowish brown cobbly silt loam
13 to 34 inches—light yellowish brown very stony silt loam and extremely stony silt loam
34 to 50 inches—light yellowish brown extremely stony loam
50 inches—hard, fractured basalt bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Volcanic ash overlying basalt
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Agatha soils on east- and west-facing escarpments and canyonsides
- Honeyjones soils on north-facing mountain slopes and canyonsides
- Ahrs soils on east- and west-facing mountain slopes and canyonsides
- Soils similar to Dorb soils with basalt bedrock at 20 to 40 inches on convex slopes and ridges
- Areas of rock outcrop on convex slopes and ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Woodland suitability subclass: 8R
Trees suitable for planting: Douglas-fir, grand fir, and western white pine
Mean site index:
Western white pine—66 (50-year site curve)
Grand fir—83 (50-year site curve)
Douglas-fir—77 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—128 cubic feet at 105 years of age
Grand fir—120 cubic feet at 104 years of age
Douglas-fir—75 cubic feet at 99 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- When building logging roads, the deep cuts needed to level the road surface can expose hard bedrock that is difficult to excavate.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Design and construct logging roads to compensate for limited depth to bedrock.

Grazeable Understory

Common forest understory plants: Darkwoods violet, goldthread, myrtle pachystima, longtube twinflower, oneleaf foamflower, queencup beadlily, bunchberry dogwood, common prince's pine, common snowberry, big blueberry, shinyleaf spirea, starry false Solomon's seal, and western rattlesnake plantain
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil and limited depth to bedrock.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil create road and trail hazards and increase maintenance costs.

Management practices:
- Design and construct roads to compensate for the steepness of slope, large stones, and limited depth to bedrock.

Interpretive Groups

Capability class: VIIe

20—Dumps, Mine-Aquic Udifluvents complex, 0 to 4 percent slopes

Composition

Dumps, Mine: 50 percent
Aquic Udifluvents: 30 percent
Contrasting inclusions: 20 percent

Setting

Landscape position: Low stream terraces
Slope range: 0 to 4 percent
Slope features: Concave to convex
Elevation: 2,600 to 3,000 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 70 to 100 days

Mine Dumps

- Mine dumps consists of areas of uneven accumulations or piles of waste rock from mine dredging.
- Mine dumps are incapable of supporting plants without major reclamation.

Aquic Udifluvents

Typical Profile

0 to 6 inches—pale brown silt loam
6 to 60 inches—stratified, variegated silt loam to extremely cobbly coarse sand

Soil Properties and Qualities

Depth class: Moderately deep to sand, gravel, and cobbles
Drainage class: Somewhat poorly drained
Parent material: Mixed alluvium derived from metasedimentary rocks mixed with slickens and mine tailings in some areas
Permeability: Moderate or moderately rapid in the upper part and moderate to very rapid below
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 18 to 24 inches—February through May; 24 to more than 60 inches—Rest of year
Hazard of flooding: Occasional: Brief—February through May

Inclusions

Contrasting inclusions:
- Typic Fluvaquents on lower positions in meander channels on low stream terraces

- Aquic Udifluvents, protected on higher, developed areas
- Udarents on higher, reclaimed areas

Use and Management

Major current uses:
- Rock quarries
- Mining activities
- Recreation
- Homesites

Vegetation

Aquic Udifluvents

Present vegetation: Black cottonwood, willow, western river alder, redosier dogwood, black hawthorn, Indianhemp dogbane, common tansy, Canada goldenrod, Columbia brome, and redtop
- Approximately 55 percent of this unit is devoid of vegetation.

Management limitations:
- Cobbles and stones limit the kind and amount of vegetation produced on this unit.
- Seeding and planting for reclamation are limited by severe droughtiness during summer months and flooding in some areas.

Management practices:
- Reshaping and addition of suitable topsoil are needed on areas of mine dumps to establish a plant cover.
- Use plants that tolerate severe droughtiness.

Building Site and Recreational Development

Management limitations:
- Areas of mine dumps are not suitable for building site and recreational development without major reclamation.
- Stones and cobbles on the surface make the construction of roads and trails difficult.
- Seasonal flooding and a high water table restrict building site and recreational development in some areas.
- Lawns, gardens, trees, and shrubs are affected by the severe droughtiness.
- Cutbanks can cave because of the sandy and gravelly substratum.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and flooding in some areas.
- The risk of seepage and the hazard of polluting the water supply limit the use of this unit as a septic tank absorption field.

Management practices:
- Reshaping, stabilization, and addition of suitable topsoil are needed on areas of mine dumps for building site and recreational development.
- Reduce wetness on the Aquic Udifluvents by providing suitably designed drainage ditches or tile drains.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Design and construct sewage disposal systems to compensate for wetness, flooding, and seepage.
- Design and construct buildings and roads to compensate for wetness and flooding in low-lying areas.
- Excavations should be designed to prevent cutbanks from caving.
- Select adapted plants in establishing lawns, shrubs, trees, and gardens.
- Suitable topsoil needs to be brought in to cover reclaimed areas of mine dumps.

Interpretive Groups

Capability class:
Mine dumps—VIIIs
Aquic Udifluvents—IVw

21—Flewsie silt loam, 35 to 65 percent slopes

Composition

Flewsie and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: Foothills
Slope range: 35 to 65 percent
Slope features: Concave to convex
Elevation: 3,000 to 4,000 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—3-inches thick
0 to 4 inches—yellowish brown silt loam
4 to 15 inches—light yellowish brown silt loam
15 to 37 inches—pale brown and pale yellow fine sandy loam
37 to 60 inches—light gray loamy fine sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from fine-grained quartzite with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layer and very severe in subsoil

Inclusions

Contrasting inclusions:
- Bouldercreek soils on north-facing canyon slopes
- Marblecreek soils on south-facing convex slopes
- Keeler, warm soils on south-facing concave slopes
- Helmer soils on concave toeslopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Western white pine—76 (50-year site curve)
Grand fir—88 (50-year site curve)
Western larch—77 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—146 cubic feet at 100 years of age
Grand fir—129 cubic feet at 98 years of age
Western larch—116 cubic feet at 70 years of age
Douglas-fir—81 cubic feet at 97 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, western larch, Douglas-fir, lodgepole pine, queencup beadlily, goldthread, and longtube twinflower
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Road cutbanks are occasionally subject to caving.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion.
- Stabilize road cutbanks to avoid the hazard of caving.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, longtube twinflower, goldthread, bunchberry dogwood, queencup beadlily, oneleaf foamflower, darkwoods violet, big blueberry, shinyleaf spirea, starry false Solomon's seal, common prince's pine, common snowberry, and western rattlesnake plantain
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to caving and erosion.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.

- Reduce the risk of erosion on steep cut-and-fill slopes by establishing a plant cover on them.
- Excavations should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

22—Flewsie silt loam, high precipitation, 35 to 65 percent slopes

Composition

Flewsie and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: Foothills
Slope range: 35 to 65 percent
Slope features: Concave to convex
Elevation: 3,300 to 4,700 feet
Mean annual precipitation: 45 to 50 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—3-inches thick
0 to 4 inches—yellowish brown silt loam
4 to 15 inches—light yellowish brown silt loam
15 to 37 inches—pale brown and pale yellow fine sandy loam
37 to 60 inches—light gray loamy fine sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from fine-grained quartzite with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and very severe in subsoil

Inclusions

Contrasting inclusions:
- Bouldercreek, high precipitation soils on north-facing canyon slopes
- Marblecreek soils on south-facing convex slopes
- Nakarna, high precipitation soils on similar landscape positions

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Western white pine, grand fir, and Douglas-fir
Mean site index:
Western white pine—76 (50-year site curve)
Grand fir—88 (50-year site curve)
Western larch—77 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—146 cubic feet at 100 years of age
Grand fir—129 cubic feet at 98 years of age
Western larch—116 cubic feet at 70 years of age
Douglas-fir—81 cubic feet at 97 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, western larch, Douglas-fir, queencup beadlily, goldthread, wild ginger, longtube twinflower, and Rocky Mountain maple
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Road cutbanks are occasionally subject to caving.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross

drains. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid the hazard of caving.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, longtube twinflower, wild ginger, western rattlesnake plantain, big blueberry, Rocky Mountain maple, darkwoods violet, goldthread, queencup beadlily, starry false Solomon's seal, and common prince's pine
Total production of air-dry vegetation (pounds per acre): 100
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Road cutbanks are subject to caving and erosion.
- Unsurfaced access roads are subject to rilling and gullying.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Reduce the risk of erosion on steep cut-and-fill slopes by establishing a plant cover on them.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

23—Flewsie-Helmer silt loams, 15 to 35 percent slopes

Composition

Flewsie and similar soils: 45 percent
Helmer and similar soils: 30 percent
Contrasting inclusions: 25 percent

Flewsie

Setting

Landscape position: Foothills
Slope range: 15 to 35 percent
Slope features: Convex
Elevation: 2,800 to 3,800 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—3-inches thick
0 to 4 inches—yellowish brown silt loam
4 to 15 inches—light yellowish brown silt loam
15 to 37 inches—pale brown and pale yellow fine sandy loam
37 to 60 inches—light gray loamy fine sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from fine-grained quartzite with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight in surface layer and severe in subsoil

Helmer

Position on landscape: Toeslopes and dissected terraces
Slope range: 15 to 25 percent

Slope features: Concave to plane, hilly
Elevation: 2,800 to 3,600 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 3 inches—brown silt loam
3 to 15 inches—light yellowish brown silt loam
15 to 18 inches—pale brown silt loam
18 to 38 inches—mixed pale brown, very pale brown, and light gray dense silt loam
38 to 60 inches—pale brown silt loam

Soil Properties and Qualities

Depth class: Shallow to a fragipan
Drainage class: Moderately well drained
Parent material: Loess deposits overlying basalt or old alluvium, with a thick mantle of volcanic ash
Permeability: Very slow
Available water capacity: Moderate
Potential rooting depth: 14 to 20 inches
Rate of surface runoff: Rapid
Hazard of water erosion: Severe
Depth to perched water table: 12 to 18 inches—February to April

Inclusions

Contrasting inclusions:
- Flewsie soils adjacent to drainageways that have slopes of more than 35 percent
- Hobo soils on dissected terraces and convex toeslopes
- Bouldercreek soils on steeper north-facing slopes
- Keeler, warm soils on steeper south-facing slopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Potential Uses:
- Homesites

Woodland

Flewsie

Woodland suitability subclass: 9A
Trees suitable for planting: Grand fir and western white pine
Mean site index:
Western white pine—76 (50-year site curve)
Grand fir—88 (50-year site curve)
Western larch—77 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—146 cubic feet at 100 years of age
Grand fir—129 cubic feet at 98 years of age
Western larch—116 cubic feet at 70 years of age
Douglas-fir—81 cubic feet at 97 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, western larch, Douglas-fir, lodgepole pine, queencup beadlily, goldthread, and longtube twinflower

Helmer

Woodland suitability subclass: 8D
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Western white pine—84 (50-year site curve)
Grand fir—82 (50-year site curve)
Douglas-fir—75 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—162 cubic feet at 100 years of age
Grand fir—118 cubic feet at 105 years of age
Douglas-fir—71 cubic feet at 100 years
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, western larch, Douglas-fir, lodgepole pine, queencup beadlily, goldthread, and longtube twinflower.
Management limitations:
- The seasonal perched water table of the Helmer soil restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails on the Helmer soil are slippery and unstable. They may be impassable during rainy periods.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- During periods of heavy rainfall and snowmelt, the perched water table in the Helmer soil is high for a period of time. Trees commonly are subject to windthrow because the soil is saturated during

these periods, and roots are limited by the cemented and compacted layer in the soil.

Management practices:

- To reduce compaction and rutting on the Helmer soil, use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Logging roads on the Helmer soil require suitable surfacing and a stable base for use during wet periods.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, northern twinflower, goldthread, bunchberry dogwood, queencup beadlily, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, big blueberry, shinyleaf spirea, common prince's pine, common snowberry, and western rattlesnake plantain

Total production of air-dry vegetation (pounds per acre): 200

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:

- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.

Management practices:

- Grazing should be delayed until the Helmer soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of the steeper areas of this unit for site development.
- Slope in some areas may limit the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping, caving, and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and the low soil strength of the Helmer soil.
- Seasonal wetness on the Helmer soil restricts building site and recreational development.
- The risk of seepage in the Flewsie soil and the hazard of polluting the water supply limit the use of this unit as a septic tank absorption field.
- Septic tank absorption fields can be expected to function poorly in the Helmer soil because of seasonal wetness and the restricted permeability of the soil.

Management practices:

- Design and construct buildings and roads to compensate for slope and frost action.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Reduce the risk of erosion on steep cut-and-fill slopes by establishing a plant cover on them.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Design and construct septic tank absorption fields on the Flewsie soil to compensate for slope and the hazard of seepage.
- Design and construct septic tank absorption fields on the Helmer soil to compensate for the slope, restricted soil permeability, and perched water table.
- Design and construct buildings and roads on Helmer soil to compensate for low soil strength and seasonal wetness.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability on the Helmer soil when wet.
- Excavations on the Flewsie soil should be designed to prevent cutbanks from caving.

Interpretive Groups

Capability class: VIe

24—Floodwood silt loam, 35 to 65 percent slopes

Composition

Floodwood and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: Foothills and mountains
Slope range: 35 to 65 percent
Slope features: Concave
Elevation: 2,400 to 4,600 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—brown silt loam
5 to 12 inches—light yellowish brown silt loam
12 to 38 inches—very pale brown loam
38 to 60 inches—pale yellow, light yellowish brown, and very pale brown fine sandy loam, gravelly loamy fine sand, and gravelly fine sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from anorthosite, schist, and gneiss with a mantle of volcanic ash
Permeability: Moderately slow in the upper part and moderately rapid to rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Severe in surface and very severe in subsoil

Inclusions

Contrasting inclusions:
- Garveson, high precipitation soils on north-, east-, and west-facing convex slopes
- Keeler, warm soils on south-facing concave slopes
- Jacot soils on north-, east-, and west-facing convex slopes at lower positions
- Bouldercreek soils on north-facing ridges and canyonsides

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 10R
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Grand fir—96 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—145 cubic feet at 92 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, oakfern, queencup beadlily, goldthread, bunchberry dogwood, and wild ginger
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.
- Road cutbanks are occasionally subject to caving.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Stabilize road cutbanks to avoid the hazard of caving.
- Reduce dustiness in summer by surfacing logging roads adequately.

Grazeable Understory

Common forest understory plants: Oakfern, queencup beadlily, goldthread, bunchberry dogwood, American maidenhair fern, common prince's pine, Oregon fairybells, starry false Solomon's seal, arrowleaf groundsel, oneleaf foamflower, longtube twinflower, and wild ginger
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,100 pounds of air-dry forage per

acre to less than 200 pounds per acre as the canopy closes.

Management limitations:

- Slope may cause livestock distribution problems.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are slippery when wet.
- Road cutbanks are subject to erosion and caving.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.

Management practices:

- Design and construct roads and trails to compensate for the steepness of slope.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Design access roads to control surface runoff on the roadway.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Reduce dustiness in summer by surfacing roads adequately.
- Excavations should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

25—Floodwood-Keeler, warm, silt loams, 15 to 35 percent slopes

Composition

Floodwood and similar soils: 50 percent
Keeler and similar soils: 30 percent
Contrasting inclusions: 20 percent

Floodwood

Setting

Position on landscape: North-, east-, and west-facing slopes of foothills
Slope range: 15 to 35 percent
Slope features: Concave
Elevation: 3,600 to 4,600 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—brown silt loam
5 to 12 inches—light yellowish brown silt loam
12 to 38 inches—very pale brown loam
38 to 60 inches—pale yellow, light yellowish brown, and very pale brown gravelly fine sandy loam, fine sandy loam, and gravelly loamy fine sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from anorthosite, schist, and gneiss with a mantle of volcanic ash
Permeability: Moderately slow in the upper part and moderately rapid to rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Moderate in surface layers and severe in subsoil

Keeler, warm

Setting

Landscape position: South-facing slopes of foothills
Slope range: 15 to 35 percent
Slope features: Convex
Elevation: 3,600 to 4,600 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—pale brown silt loam
5 to 16 inches—light yellowish brown silt loam
16 to 36 inches—very pale brown silt loam and loam
36 to 60 inches—very pale brown and reddish yellow sandy loam and sandy clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from granite with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Severe

Inclusions

Contrasting inclusions:
- Odonnell soils on less sloping concave toeslopes
- Jacot soils on north-facing convex slopes

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed

Woodland

Floodwood

Woodland suitability subclass: 10A
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Grand fir—96 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—145 cubic feet at 92 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, oakfern, queencup beadlily, goldthread, bunchberry dogwood, and wild ginger

Keeler, warm

Woodland suitability subclass: 9A
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Western white pine—80 (50-year site curve)
Grand fir—88 (50-year site curve)
Western larch—71 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—154 cubic feet at 100 years of age
Grand fir—129 cubic feet at 98 years of age
Western larch—103 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, starry false Solomon's seal, goldthread, and longtube twinflower

Management limitations:
- Road cutbanks on the Floodwood soil are occasionally subject to caving.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.

Management practices:
- Use conventional equipment in harvesting timber.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Adequately designed road drainage reduces the risk of gully erosion on the roadway.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Reduce dustiness in summer by surfacing logging roads adequately.
- Stabilize road cutbanks on the Floodwood soil to avoid the hazard of caving.

Grazeable Understory

Floodwood

Common forest understory plants: Oakfern, queencup beadlily, goldthread, arrowleaf groundsel, oneleaf foamflower, longtube twinflower, bunchberry dogwood, American maidenhair fern, common prince's pine, Oregon fairybells, starry false Solomon's seal, and wild ginger

Keeler, warm

Common forest understory plants: Longtube twinflower, Columbia brome, starry false Solomon's seal, darkwoods violet, baldhip rose, Utah honeysuckle, western rattlesnake plantain, common snowberry, goldthread, oneleaf foamflower, queencup beadlily, common prince's pine, and dampwoods blueberry
Total production of air-dry vegetation (pounds per acre): 200

Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,200 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of the steeper areas of this unit for site development.
- Slope in some areas may limit the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are slippery when wet.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- The hazard of seepage may cause contamination of nearby streams from sanitary facilities.
- Cutbanks can cave on the Floodwood soil because of the sandy substratum.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads, trails, and camp areas to compensate for slope.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Reduce dustiness in summer by surfacing roads adequately.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Design and build structures and roads to compensate for frost action.
- Excavations on the Floodwood soil should be designed to prevent cutbanks from caving.
- Design and construct sanitary facilities on the Floodwood soil to compensate for the hazard of seepage.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.
- Because of the risk of seepage on the Floodwood soil, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIe

26—Floodwood-Keeler, warm, silt loams, 35 to 65 percent slopes

Composition

Floodwood and similar soils: 50 percent
Keeler and similar soils: 30 percent
Contrasting inclusions: 20 percent

Floodwood

Setting

Landscape position: North-, east-, and west-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Concave
Elevation: 2,600 to 4,600 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—brown silt loam
5 to 12 inches—light yellowish brown silt loam
12 to 38 inches—very pale brown loam
38 to 60 inches—pale yellow, light yellowish brown, and very pale brown gravelly fine sandy loam, fine sandy loam, and gravelly loamy fine sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from anorthosite, schist, and gneiss with a mantle of volcanic ash
Permeability: Moderately slow in the upper part and moderately rapid to rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid and very rapid
Hazard of water erosion: Severe in surface layers and very severe in subsoil

Keeler, warm

Setting

Landscape position: South-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,600 to 4,600 feet

Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—pale brown silt loam
5 to 16 inches—light yellowish brown silt loam
16 to 36 inches—very pale brown silt loam and loam
36 to 60 inches—very pale brown and reddish yellow sandy loam and sandy clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from granite with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Very severe

Inclusions

Contrasting inclusions:
- Garveson soils on north-, east-, and west-facing convex slopes
- Odonnell soils on less sloping concave toeslopes
- Bouldercreek soils on north-facing convex ridges and canyonsides

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed

Woodland

Floodwood

Woodland suitability subclass: 10R
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Grand fir—96 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—145 cubic feet at 92 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, oakfern, queencup beadlily, goldthread, bunchberry dogwood, and wild ginger

Keeler, warm

Woodland suitability subclass: 9R
Trees suitable for planting: Western white pine and grand fir.
Mean site index:
Western white pine—80 (50-year site curve)
Grand fir—88 (50-year site curve)
Western larch—71 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—154 cubic feet at 100 years of age
Grand fir—129 cubic feet at 98 years of age
Western larch—103 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, starry false Solomon's seal, goldthread, and longtube twinflower

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Road cutbanks on the Floodwood soil are occasionally subject to caving.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Reduce dustiness in summer by surfacing logging roads adequately.
- Stabilize road cutbanks on the Floodwood soil to avoid the hazard of caving.

Grazeable Understory

Floodwood

Common forest understory plants: Oakfern, queencup beadlily, goldthread, bunchberry dogwood, American maidenhair fern, common prince's pine, Oregon fairybells, arrowleaf groundsel, oneleaf foamflower, longtube twinflower, starry false Solomon's seal, and wild ginger

Keeler, warm

Common forest understory plants: Columbia brome, oneleaf foamflower, queencup beadlily, goldthread, longtube twinflower, starry false Solomon's seal, common prince's pine, western rattlesnake plantain, darkwoods violet, common snowberry, baldhip rose, Utah honeysuckle, and dampwoods blueberry

Total production of air-dry vegetation (pounds per acre): 200

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,200 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:

- Slope may cause livestock distribution problems.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are slippery when wet.
- Road cutbanks are subject to caving on the Floodwood soil.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.

Management practices:

- Design and construct roads and trails to compensate for the steepness of slope.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Reduce dustiness in summer by surfacing roads adequately.
- Excavations on the Floodwood soil should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.
- Because of the risk of seepage on the Floodwood soil, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

27—Garveson, high precipitation-Floodwood silt loams, 35 to 65 percent slopes

Composition

Garveson, high precipitation and similar soils: 50 percent
Floodwood and similar soils: 30 percent
Contrasting inclusions: 20 percent

Garveson, high precipitation

Setting

Landscape position: Mountains
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,800 to 4,800 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—brown silt loam
2 to 16 inches—yellowish brown and light yellowish brown silt loam
16 to 23 inches—pale brown very gravelly loamy coarse sand
23 to 60 inches—very pale brown and variegated very gravelly loamy coarse sand and very gravelly coarse sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from granitic bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid to very rapid below
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and severe gully erosion in subsoil

Floodwood

Setting

Landscape position: Mountains
Slope range: 35 to 65 percent
Slope features: Concave
Elevation: 2,800 to 4,800 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—brown silt loam
5 to 12 inches—light yellowish brown silt loam
12 to 38 inches—very pale brown loam
38 to 60 inches—pale yellow, light yellowish brown, and very pale brown gravelly fine sandy loam, fine sandy loam, and gravelly loamy fine sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from anorthosite, schist, and gneiss with a mantle of volcanic ash
Permeability: Moderately slow in the upper part and moderately rapid to rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Severe in surface layers and very severe in subsoil

Inclusions

Contrasting inclusions:
Soils similar to Garveson soils with soft bedrock at 40 to 60 inches on ridges
Bouldercreek soils on north-facing mountain slopes and canyonsides
Jacot soils on convex slopes at lower positions

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed

Woodland

Garveson, high precipitation

Woodland suitability subclass: 11R
Trees suitable for planting: Grand fir and western white pine
Mean site index:
Grand fir—99 (50-year site curve)
Douglas-fir—85 (50-year site curve)
Western white pine—94 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—151 cubic feet at 90 years of age
Douglas-fir—92 cubic feet at 94 years of age
Western white pine—182 cubic feet at 90 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, lodgepole pine, western larch, queencup beadlily, goldthread, bunchberry dogwood, and wild ginger

Floodwood

Woodland suitability subclass: 10R
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Grand fir—96 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—145 cubic feet at 92 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, oakfern, queencup beadlily, goldthread, bunchberry dogwood, and wild ginger

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Road cutbanks are occasionally subject to caving.

- When wet, unsurfaced roads and skid trails on the Floodwood soil are slippery and unstable. They may be impassable during rainy periods.
- Unless an adequate wearing surface is maintained on the Floodwood soil, dusty conditions in summer create road hazards and increase maintenance costs.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Adequately designed road drainage reduces the risk of gully erosion on the roadway.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.
- Logging roads on the Floodwood soil require suitable surfacing and a stable base for use during wet periods.
- Reduce dustiness in summer by surfacing logging roads adequately on the Floodwood soil.
- Stabilize road cutbanks to avoid the hazard of caving.

Grazeable Understory

Garveson, high precipitation

Common forest understory plants: Longtube twinflower, goldthread, queencup beadlily, myrtle pachystima, Pacific trillium, starry false Solomon's seal, oneleaf foamflower, bunchberry dogwood, common prince's pine, and wild ginger

Floodwood

Common forest understory plants: Oakfern, queencup beadlily, goldthread, bunchberry dogwood, American maidenhair fern, common prince's pine, Oregon fairybells, arrowleaf groundsel, oneleaf foamflower, longtube twinflower, starry false Solomon's seal, and wild ginger

Total production of air-dry vegetation (pounds per acre): 200

Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,200 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are slippery when wet on the Floodwood soil.
- Road cutbanks are subject to caving.
- Unless an adequate wearing surface is maintained on the Floodwood soil, dusty conditions in summer create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Reduce the risk of erosion on steep cut-and-fill slopes by establishing a plant cover on them.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet on the Floodwood soil.
- Reduce dustiness in summer on the Floodwood soil by surfacing roads adequately.
- Excavations should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

28—Goatrock-Rock outcrop complex, 35 to 75 percent slopes

Composition

Goatrock and similar soils: 55 percent
Rock outcrop: 25 percent
Contrasting inclusions: 20 percent

Goatrock

Setting

Landscape position: South-facing high elevation mountain slopes
Slope range: 35 to 75 percent
Slope features: Convex
Elevation: 5,000 to 6,300 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—0.5-inch thick
0 to 8 inches—grayish brown very stony silt loam
8 to 26 inches—brown and yellowish brown very cobbly silt loam and extremely cobbly silt loam
26 to 60 inches—light yellowish brown and very pale brown extremely gravelly sandy loam and extremely gravelly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Stones on the surface: 0.1 to 3.0 percent
Parent material: Weathered material derived from granite, gneiss, or schist bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid to rapid below
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Rock outcrop

Setting

Landscape position: Ridges and convex slopes
- Rock outcrop consists of areas of exposed granite, gneiss, or schist bedrock.
- Areas of rock outcrop are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Rubble land on plane to concave slopes below areas of rock outcrop
- Vaywood soils on east- and west-facing mountain slopes

Use and Management

Major current uses:
- Wildlife habitat
- Recreation
- Watershed

Potential uses:
- Livestock grazing

Grazeable Vegetation

Dominant vegetation in potential natural plant community: Scattered, stunted whitebark pine and subalpine fir, big blueberry, common yarrow, Sitka mountain ash, common beargrass, Columbia brome, elk sedge, and green fescue
Potential production of air-dry vegetation (pounds per acre):

Goatrock

Favorable years—1,200
Unfavorable years—800
- Areas of rock outcrop reduce yields by about 25 percent.

Management limitations:
- The production of forage is limited by surface stoniness and areas of rock outcrop, which also interfere with the movement of livestock and limit the accessibility of forage.
- Slope may cause livestock distribution problems.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Areas of rock outcrop in some areas may interfere with the use of construction equipment.
- Stones and cobbles on the surface and in the soil make the construction of roads and trails difficult.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.
- Road cutbanks are subject to caving.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope, large stones, and areas of rock outcrop.
- Design roads to prevent cutbanks from caving.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class:
Goatrock soil—VIIs
Rock outcrop—VIIIs

29—Helmer silt loam, 3 to 20 percent slopes

Composition

Helmer and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Dissected terraces
Slope range: 3 to 20 percent
Slope features: Concave to convex
Elevation: 2,160 to 3,300 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 3 inches—brown silt loam
3 to 15 inches—light yellowish brown silt loam
15 to 18 inches—pale brown silt loam
18 to 38 inches—mixed pale brown, very pale brown, and light gray dense silt loam
38 to 60 inches—pale brown silt loam

Soil Properties and Qualities

Depth class: Shallow to a fragipan
Drainage class: Moderately well drained
Parent material: Loess deposits overlying basalt or old alluvium, with a thick mantle of volcanic ash
Permeability: Very slow
Available water capacity: Moderate
Potential rooting depth: 14 to 20 inches
Rate of surface runoff: Rapid
Hazard of water erosion: Severe
Depth to perched water table: 12 to 18 inches—February to April

Inclusions

Contrasting inclusions:
- Reggear soils on south-facing terraces
- Agatha soils on east- and west-facing terrace escarpments
- Bobbitt soils on south-facing terrace escarpments
- Dorb soils on north-facing terrace escarpments
- Sly soils on higher or steeper positions of terraces

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Hayland
- Pastureland
- Homesites
- Recreation
- Wildlife habitat

Hayland and Pastureland

- Adapted improved forage plants are timothy, tall fescue, orchardgrass, smooth brome, and clover.

Management limitations:
- The soil ties up large amounts of phosphorus, which limits the amount that is available to plants.
- Shallow rooting depth and wetness reduce the choice of plants adaptable to this unit.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.

Management practices:
- Seed only forage plants that tolerate seasonal wetness and shallow rooting depth.
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Phosphorus should be applied to overcome soil deficiencies.

Woodland

Woodland suitability group: 8D
Trees suitable for planting: Western white pine, Douglas-fir, and grand fir
Mean site index:
Western white pine—84 (50-year site curve)
Douglas-fir—75 (50-year site curve)
Grand fir—82 (50-year site curve)

Estimated average annual production (CMAI):
Western white pine—162 cubic feet at 100 years of age
Douglas-fir—71 cubic feet at 100 years of age
Grand fir—118 cubic feet at 105 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western white pine, Douglas-fir, grand fir, western red cedar, western larch, lodgepole pine, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread
Management limitations:
- The seasonal perched water table restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- During periods of heavy rainfall and snowmelt, the perched water table is high for a period of time. Trees commonly are subject to windthrow because the soil is saturated during these periods, and roots are limited by the cemented and compacted layer in the soil.

Management practices:
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets or mulching. These are needed to prevent erosion and sediment delivery.
- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- To reduce compaction and rutting, use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Stabilize road cutbanks to avoid slumping onto roadways.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, goldthread, longtube twinflower, oneleaf foamflower, darkwoods violet, big blueberry, shinyleaf spirea, queencup beadlily, common snowberry, bunchberry dogwood, common prince's pine, western rattlesnake plantain, and starry false Solomon's seal
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,400 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Seasonal wetness restricts building site and recreational development.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.

Management practices:
- Design and construct buildings and roads to compensate for seasonal wetness, low soil strength, and frost action.
- Construct roads with heavy base rock for year-round use.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design and construct septic tank absorption fields to compensate for seasonal wetness and restricted soil permeability.

Interpretive Groups

Capability class: VIe

30—Helmer-Sly silt loams, 3 to 25 percent slopes

Composition

Helmer and similar soils: 45 percent
Sly and similar soils: 40 percent
Contrasting inclusions: 15 percent

Helmer

Setting

Landscape position: Dissected terraces
Slope range: 3 to 25 percent
Slope features: Concave to plane
Elevation: 2,160 to 3,400 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 3 inches—brown silt loam
3 to 15 inches—light yellowish brown silt loam
15 to 18 inches—pale brown silt loam
18 to 38 inches—mixed pale brown, very pale brown, and light gray dense silt loam
38 to 60 inches—pale brown silt loam

Soil Properties and Qualities

Depth class: Shallow to a fragipan
Drainage class: Moderately well drained
Parent material: Loess deposits overlying basalt or old alluvium, with a thick mantle of volcanic ash
Permeability: Very slow
Available water capacity: Moderate
Potential rooting depth: 14 to 20 inches
Rate of surface runoff: Rapid
Hazard of water erosion: Severe
Depth to perched water table: 12 to 18 inches—February to April

Sly

Setting

Landscape position: Dissected terraces
Slope range: 3 to 25 percent
Slope features: Plane to convex
Elevation: 2,160 to 3,400 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown silt loam
3 to 9 inches—pale brown silt loam
9 to 36 inches—pale brown silt loam
36 to 60 inches—mixed pale brown and brown silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess deposits with minor amounts of volcanic ash overlying basalt
Permeability: Moderately slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Severe

Inclusions

Contrasting inclusions:
- Reggear soils on south-facing terraces
- Agatha soils on east- and west-facing terrace escarpments
- Soils similar to Sly soils that have basalt bedrock at depths of 40 to 60 inches on terrace escarpments

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Hayland
- Pastureland
- Homesites
- Recreation
- Wildlife habitat

Hayland and Pastureland

- Adapted improved forage plants are timothy, tall fescue, orchardgrass, smooth brome, and clover.

Management limitations:
- Wetness of the Helmer soil limits the choice of plants, and the period of cutting or grazing.
- Shallow rooting depth on the Helmer soil reduces the choice of plants adaptable to this unit.
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.
- The Helmer soil ties up large amounts of phosphorus, which limits the amount available to plants.

Management practices:
- Seed only forage plants that tolerate seasonal wetness and shallow rooting depth.
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Phosphorus should be applied to overcome soil deficiencies.

Woodland

Helmer

Woodland suitability subclass: 8D
Trees suitable for planting: Douglas-fir, grand fir, and western white pine (fig. 10)
Mean site index:
Western white pine—84 (50-year site curve)
Douglas-fir—75 (50-year site curve)
Grand fir—82 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—162 cubic feet at 100 years of age
Douglas-fir—71 cubic feet at 100 years of age
Grand fir—118 cubic feet at 105 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, Douglas-fir, grand fir, western larch, lodgepole pine, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread

Sly

Woodland suitability subclass: 9A
Trees suitable for planting: Douglas-fir, grand fir, and western white pine (fig. 10)
Mean site index:
Grand fir—90 (50-year site curve)
Western white pine—93 (50-year site curve)
Douglas-fir—86 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—133 cubic feet at 96 years of age
Western white pine—180 cubic feet at 95 years of age
Douglas-fir—95 cubic feet at 93 years
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, Douglas-fir, grand fir, western larch, lodgepole pine, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread

Management limitations:
- The seasonal perched water table on the Helmer soil restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- During periods of heavy rainfall and snowmelt, the perched water table on the Helmer soil is high for a period of time. Trees commonly are subject to windthrow because the soil is saturated during these periods, and roots are limited by the cemented and compacted layer in the soil.

Management practices:
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- To reduce compaction and rutting, use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Stabilize road cutbanks to avoid slumping onto roadways.

Grazeable Understory

Common forest understory plants: Longtube twinflower, goldthread, queencup beadlily, western rattlesnake plantain, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, myrtle pachystima, big blueberry, and shinyleaf spirea
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,400 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Figure 10.—An area of Helmer-Sly silt loams, 3 to 25 percent slopes, with a tree plantation in a clearcut area.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Seasonal wetness restricts building site and recreational development.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.
- Slope limits the use of the steeper areas of this unit for site development.

Management practices:
- Design and construct buildings and roads to compensate for slope in some areas, low soil strength, seasonal wetness on the Helmer soil, and frost action.

- Construct roads with heavy base rock for year-round use.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design and construct septic tank absorption fields to compensate for slope in some areas, restricted soil permeability, and seasonal wetness on the Helmer soil.

Interpretive Groups

Capability class: VIe

31—Helmer-Sly silt loams, 25 to 40 percent slopes

Composition

Helmer and similar soils: 45 percent
Sly and similar soils: 40 percent
Contrasting inclusions: 15 percent

Helmer

Setting

Landscape position: Dissected terraces
Slope range: 25 to 35 percent
Slope features: Plane to concave
Elevation: 2,160 to 3,400 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 3 inches—brown silt loam
3 to 15 inches—light yellowish brown silt loam
15 to 18 inches—pale brown silt loam
18 to 38 inches—mixed pale brown, very pale brown, and light gray dense silt loam
38 to 60 inches—pale brown silt loam

Soil Properties and Qualities

Depth class: Shallow to a fragipan
Drainage class: Moderately well drained
Parent material: Loess deposits overlying basalt or old alluvium, with a thick mantle of volcanic ash
Permeability: Very slow
Available water capacity: Moderate
Potential rooting depth: 14 to 20 inches
Rate of surface runoff: Very rapid
Hazard of water erosion: Very severe
Depth to perched water table: 12 to 18 inches—February to April

Sly

Setting

Landscape position: Dissected terraces
Slope range: 25 to 40 percent
Slope features: Plane to convex
Elevation: 2,160 to 3,400 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown silt loam
3 to 9 inches—pale brown silt loam
9 to 36 inches—pale brown silt loam
36 to 60 inches—mixed pale brown and brown silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess deposits with minor amounts of volcanic ash overlying basalt
Permeability: Moderately slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Very rapid
Hazard of water erosion: Very severe

Inclusions

Contrasting inclusions:
- Dorb soils on north-facing escarpments
- Agatha soils on east- and west-facing escarpments
- Reggear soils on south-facing terrace slopes
- Bobbitt soils on south-facing escarpments

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Helmer

Woodland suitability subclass: 8D
Trees suitable for planting: Douglas-fir, grand fir, and western white pine
Mean site index:
Western white pine—84 (50-year site curve)
Douglas-fir—75 (50-year site curve)
Grand fir—82 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—162 cubic feet at 100 years
Douglas-fir—71 cubic feet at 100 years of age
Grand fir—118 cubic feet at 105 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread

Sly

Woodland suitability subclass: 9A
Trees suitable for planting: Douglas-fir, grand fir, and western white pine
Mean site index for stated species:
Grand fir—90 (50-year site curve)
Western white pine—93 (50-year site curve)
Douglas-fir—86 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—133 cubic feet at 96 years of age
Western white pine—180 cubic feet at 95 years of age
Douglas-fir—95 cubic feet at 93 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread

Management limitations:
- Slope in steeper areas limits the kinds of equipment that can be used in forest management.
- The seasonal perched water table on the Helmer soil restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- During periods of heavy rainfall and snowmelt, the perched water table on the Helmer soil is high for a period of time. Trees commonly are subject to windthrow because the soil is saturated during these periods, and roots are limited by the cemented and compacted layer in the soil.

Management practices:
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- To reduce compaction and rutting, use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Because sliding and slumping can result if the soil is disturbed, use the kind of logging methods that disturb the soil least and stabilize cuts and fills.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, goldthread, longtube twinflower, queencup beadlily, oneleaf foamflower, darkwoods violet, common snowberry, big blueberry, shinyleaf spirea, bunchberry dogwood, common prince's pine, western rattlesnake plantain, and starry false Solomon's seal
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,400 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff and lower forage production.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Road cutbanks are subject to slumping and erosion.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Seasonal wetness restricts building site and recreational development.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.

Management practices:
- Design and construct buildings and roads to compensate for slope, low soil strength, frost action, hazard of slippage, and seasonal wetness.
- Construct roads with heavy base rock for year-round use.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Stabilize disturbed areas to reduce the risk of erosion and the hazard of soil slippage.
- Reduce the risk of erosion on steep cut-and-fill slopes by establishing a plant cover on them.
- Design and construct septic tank absorption fields to compensate for slope, restricted soil permeability, hazard of slippage, and seasonal wetness on the Helmer soil.

Interpretive Groups

Capability class: VIIe

32—Hobo silt loam, 15 to 35 percent slopes

Composition

Hobo and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Foothills and dissected terraces
Slope range: 15 to 35 percent
Slope features: Convex to concave
Elevation: 2,800 to 4,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—grayish brown silt loam
2 to 15 inches—yellowish brown and light yellowish brown silt loam
15 to 22 inches—very pale brown silt loam
22 to 32 inches—mixed light brown and very pale brown silt loam
32 to 45 inches—light brown gravelly silty clay loam
45 to 60 inches—reddish yellow very gravelly clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks, with a thick mantle of volcanic ash
Permeability: Slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Moderate in surface and severe in subsoil
Depth to seasonal perched water table: 12 to 24 inches—February to April

Inclusions

Contrasting inclusions:
- Hugus soils on steeper, north-facing slopes
- Tigley soils on steeper, south-facing slopes
- Bouldercreek soils on steeper, north-facing slopes
- Marblecreek soils on steeper, south-facing slopes
- Helmer soils on toeslopes and flatter terraces

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Woodland suitability subclass: 10A

Trees suitable for planting: Western white pine, western larch, and grand fir
Mean site index:
Grand fir—96 (50-year site curve)
Western white pine—78 (50-year site curve)
Western larch—79 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—145 cubic feet at 92 years of age
Western white pine—150 cubic feet at 100 years of age
Western larch—120 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, and longtube twinflower
Management limitations:
- The seasonal perched water table restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Constructing roads at midslope results in large cuts and fills which increase the risk of slumping and erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.

Grazeable Understory

Common forest understory plants: Longtube twinflower, goldthread, queencup beadlily, western rattlesnake plantain, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, myrtle pachystima, big blueberry, and shinyleaf spirea
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Seasonal wetness restricts building site and recreational development.
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.

Management practices:
- Design and construct buildings, roads, camp areas, and sanitary facilities to compensate for slope and seasonal wetness.
- Because the soil is subject to slumping and slippage, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize these risks.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Design and construct buildings and roads to compensate for frost action and the hazard of soil slippage.

Interpretive Groups

Capability class: VIe

33—Hobo silt loam, moderately acid, 15 to 35 percent slopes

Composition

Hobo and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: South-facing foothills and dissected terraces
Slope range: 15 to 35 percent
Slope features: Plane to concave
Elevation: 2,250 to 3,000 feet
Mean annual precipitation: 32 to 35 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 4 inches—dark brown silt loam, moderately acid, moderate concentrations of heavy metals
4 to 11 inches—brown silt loam, moderately acid, moderate concentrations of heavy metals
11 to 21 inches—brown silt loam
21 to 40 inches—reddish yellow, very pale brown, and strong brown gravelly silty clay loam
40 to 60 inches—reddish yellow very gravelly silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks, with a thick mantle of volcanic ash
Permeability: Slow
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Moderate in surface layer and severe in subsoil
Depth to perched water table: 12 to 24 inches—February to April
Acidity: Moderately acid in the surface layers

Inclusions

Contrasting inclusions:
- Moderately acid soils similar to Tigley soils on southeast- and southwest-facing convex slopes
- Strongly acid Hobo soils on north-facing concave slopes
- Moderately acid soils similar to Helmer soils on north-, east-, and west-facing toeslopes and flatter terraces
- Moderately acid soils with bedrock at 40 to 60 inches that are similar to Tigley soils on south-facing convex slopes

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Homesites

Woodland

Woodland suitability subclass: 10T
Trees suitable for planting: Western white pine, western larch, and ponderosa pine
Mean site index:
Western white pine—78 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—150 cubic feet at 100 years of age
Dominant vegetation in potential natural plant community: Western white pine, western larch, ponderosa pine, lodgepole pine, Rocky Mountain maple, willow, red alder, Lewis' mock orange, serviceberry, common chokecherry, Oregon fairybells, common snowberry, redstem ceanothus, queencup beadlily, starry false Solomon's seal, Utah honeysuckle, Indianhemp dogbane, goldthread, and brackenfern
- The presence of heavy metals and higher than normal soil acidity have modified the normal plant succession. Normal habitat type is grand fir/queencup beadlily.
- Woodland productivity data was very limited on this soil because few trees were of suitable age.
- Approximately 10 percent of this unit is devoid of vegetation.

Management limitations:
- The seasonal perched water table restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.

- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.
- Moderate acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.

Management practices:

- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.
- To reduce compaction and rutting use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Use plants and trees that tolerate moderate acidity and concentrations of heavy metals.
- Prepare the site carefully to control competing brushy vegetation.

Building Site and Recreational Development

Management limitations:

- Seasonal wetness restricts building site and recreational development.
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:

- Design and construct buildings, roads, and trails to compensate for slope.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design and construct buildings and roads to compensate for seasonal wetness, frost action, and low soil strength.
- Design and construct septic tank absorption fields to compensate for seasonal wetness, restricted soil permeability, and slope.
- Select adapted plants in establishing lawns, shrubs, trees, and gardens.

Interpretive Groups

Capability class: VIe

34—Hobo silt loam, strongly acid, 15 to 35 percent slopes

Composition

Hobo and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: North-, east-, and west-facing foothills and dissected terraces
Slope range: 15 to 35 percent
Slope features: Plane to concave
Elevation: 2,300 to 3,400 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2.5-inches thick
0 to 2 inches—brown silt loam, strongly acid, moderate concentrations of heavy metals
2 to 14 inches—light yellowish brown silt loam

14 to 17 inches—very pale brown silt
17 to 31 inches—mixed very pale brown and light yellowish brown gravelly and cobbly silt loam
31 to 45 inches—pale brown very cobbly silt loam
45 to 60 inches—very pale brown extremely stony silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks, with a thick mantle of volcanic ash
Permeability: Slow
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Moderate in surface layer and severe in subsoil
Depth to perched water table: 12 to 24 inches—February to April
Acidity: Strongly acid in the surface layer

Inclusions

Contrasting inclusions:
- Strongly acid soils similar to Hugus soils but moderately well drained on north-facing convex slopes
- Strongly acid soils similar to Tigley soils on south-facing slopes
- Strongly acid soils similar to Helmer soils on north-, east-, and west-facing toeslopes and flatter terraces

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Homesites

Woodland

Woodland suitability subclass: 10T
Trees suitable for planting: Western white pine, western larch, lodgepole pine, and ponderosa pine
Mean site index (estimated): Western white pine—78 (50-year site curve)
Estimated average annual production (CMAI): Western white pine—150 cubic feet at 100 years of age
Dominant vegetation in potential natural plant community: Western white pine, western larch, lodgepole pine, quaking aspen, red alder, willow, queencup beadlily, starry false Solomon's seal, bunchberry dogwood, Utah honeysuckle, goldthread, pine reedgrass, brackenfern, redtop, bearberry, common snowberry, and Rocky Mountain maple
- The presence of heavy metals and higher than normal soil acidity have modified the normal plant succession. Normal habitat type is western hemlock/queencup beadlily.
- Woodland productivity data was very limited on this soil because few trees were of suitable age.

Management limitations:
- The seasonal perched water table restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.

Management practices:
- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- To reduce compaction and rutting use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.
- Use plants and trees that tolerate high acidity and concentrations of heavy metals.
- When planting shrubs and trees on this unit, it may be necessary to remove the existing toxic soil in small areas and replace it with good topsoil.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Seasonal wetness restricts building site and recreational development.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.
- Recreational development is limited by soil toxicity from heavy metals.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:
- Design and construct buildings and roads to compensate for slope, frost action, seasonal wetness, and low soil strength.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Design and construct septic tank absorption fields to compensate for seasonal wetness, restricted soil permeability, and slope.
- Select adapted plants in establishing lawns, shrubs, trees, and gardens.
- Suitable topsoil may need to be brought in to replace toxic soil.

Interpretive Groups

Capability class: VIe

35—Hobo silt loam, very strongly acid, 15 to 35 percent slopes, eroded

Composition

Hobo and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: North-, east-, and west-facing foothills and dissected terraces
Slope range: 15 to 35 percent
Slope features: Plane to concave
Elevation: 2,250 to 3,000 feet
Mean annual precipitation: 32 to 35 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

0 to 4 inches—pale brown silt loam, very strongly acid, high concentrations of heavy metals
4 to 9 inches—light yellowish brown silt loam, very strongly acid
9 to 24 inches—very pale brown, light gray, and light yellowish brown silt loam and silt
24 to 35 inches—very pale brown and light gray gravelly silt loam
35 to 46 inches—reddish yellow gravelly silty clay loam
46 to 60 inches—reddish yellow very cobbly silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks, with a thick mantle of volcanic ash
Permeability: Slow
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Severe
Depth to perched water table: 12 to 24 inches—February to April
Acidity: Very strongly acid in the surface layers

Inclusions

Contrasting inclusions:
- Hobo extremely acid, severely eroded soils on steeper north-, east-, and west-facing slopes
- Helmer, severely eroded soils on north-, east-, and west-facing toeslopes
- Soils with a very cobbly silt loam fragipan that are similar to Helmer soils on terrace slopes near drainageways
- Strongly acid soils similar to Tigley soils on south-facing slopes

Use and Management

Major current uses:
- Mining activities
- Homesites
- Recreation

Vegetation

Trees suitable for planting: Western white pine, Austrian pine, ponderosa pine, and western larch

Present vegetation: Small western white pine, quaking aspen, blue elderberry, serviceberry, Columbia hawthorn, willow, oatgrass, pine reedgrass, Rocky Mountain maple, Oregon fairybells, common snowberry, starry false Solomon's seal, Utah honeysuckle, Indianhemp dogbane, brackenfern, and redtop
- The presence of heavy metals and much higher than normal soil acidity have noticeably reduced the plant succession on this map unit. Normal habitat type is western hemlock/queencup beadlily.
- Approximately 30 percent of this unit is devoid of vegetation.

Management limitations:
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.
- Livestock grazing is not feasible on this unit due to lack of suitable forage vegetation and concentration of heavy metals.
- Seeding and planting are limited by the seasonal perched water table, restricted permeability, water erosion, and slope in some areas.

Management practices:
- Stabilize eroded areas before seeding and planting.
- Use plants and trees that tolerate high acidity and concentrations of heavy metals.
- When planting shrubs and trees on this unit, it may be necessary to remove the existing toxic soil in small areas and replace it with good topsoil.
- The application of nitrogen fertilizer and other soil amendments is essential for plant establishment on this unit. Obtain a soil test for proper fertilizer management.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Seasonal wetness restricts building site and recreational development.
- Recreational development is limited by soil toxicity from heavy metals.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:
- Design and construct buildings and roads to compensate for slope, seasonal wetness, frost action, and low soil strength.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design roads and trails to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design and construct septic tank absorption fields to compensate for seasonal wetness, restricted soil permeability, and slope.
- Select adapted plants in establishing lawns, shrubs, trees, and gardens.
- Suitable topsoil may need to be brought in to replace toxic soil.

Interpretive Groups

Capability class: VIe

36—Hobo-Helmer silt loams, 5 to 25 percent slopes

Composition

Hobo and similar soils: 45 percent
Helmer and similar soils: 40 percent
Contrasting inclusions: 15 percent

Hobo

Setting

Landscape position: Foothills and dissected terraces
Slope range: 5 to 25 percent
Slope features: Plane to convex
Elevation: 2,140 to 3,800 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—grayish brown silt loam
2 to 15 inches—yellowish brown and light yellowish brown silt loam
15 to 22 inches—very pale brown silt loam
22 to 32 inches—mixed light brown and very pale brown silt loam
32 to 45 inches—light brown gravelly silty clay loam
45 to 60 inches—reddish yellow very gravelly clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks, with a thick mantle of volcanic ash
Permeability: Slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate to severe
Depth to perched water table: 12 to 24 inches—February to April

Helmer

Setting

Landscape position: Terraces and toeslopes
Slope range: 5 to 25 percent
Slope features: Plane to concave
Elevation: 2,140 to 3,800 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—brown silt loam
2 to 18 inches—yellowish brown and light brown silt loam
18 to 33 inches—mixed very pale brown and light yellowish brown dense silt loam
33 to 48 inches—light brown dense silty clay loam
48 to 60 inches—light yellowish brown gravelly silt loam

Soil Properties and Qualities

Depth class: Shallow to a fragipan
Drainage class: Moderately well drained
Parent material: Loess deposits overlying old alluvium, with a thick mantle of volcanic ash
Permeability: Very slow
Available water capacity: Moderate
Potential rooting depth: 14 to 20 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate to severe
Depth to perched water table: 12 to 18 inches—February to April

Inclusions

Contrasting inclusions:
- Hugus soils on steeper, north-facing slopes
- Tigley soils on steeper, south-facing convex slopes
- Ahrs soils on steeper, south-facing convex slopes
- Honeyjones soils on steeper, north-facing slopes
- Clarkia soils in drainageways and bottomlands

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Hayland
- Pastureland
- Homesites
- Recreation
- Wildlife habitat

Hayland and Pastureland

- This unit is suited to nonirrigated hayland and pasture with some limitations. If a high level of management is used, yields of adapted grasses and legumes are fair. Some of the adapted forage plants are orchardgrass, smooth brome, tall fescue, meadow foxtail, timothy, and clover.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Shallow rooting depth on the Helmer soil reduces the choice of plants adaptable to this unit.
- The soils tie up large amounts of phosphorus, which limits the amount available to plants.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Seed only forage plants that tolerate seasonal wetness and shallow rooting depth.
- Phosphorus should be applied to overcome soil deficiencies.

Woodland

Hobo

Woodland suitability subclass: 10A
Trees suitable for planting: Douglas-fir, western white pine, and grand fir
Mean site index:
Western white pine—78 (50-year site curve)
Grand fir—96 (50-year site curve)
Western larch—79 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—150 cubic feet at 100 years of age
Grand fir—145 cubic feet at 92 years of age
Western larch—120 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, and longtube twinflower

Helmer

Woodland suitability subclass: 8D
Trees suitable for planting: Douglas-fir, western white pine, and grand fir
Mean site index:
Western white pine—84 (50-year site curve)
Grand fir—82 (50-year site curve)
Douglas-fir—75 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—162 cubic feet at 100 years of age
Grand fir—118 cubic feet at 105 years of age
Douglas-fir—71 cubic feet at 100 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, and longtube twinflower

Management limitations:
- The seasonal perched water table restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- During periods of heavy rainfall and snowmelt, the perched water table is high on the Helmer soil for a period of time. Trees commonly are subject to windthrow because the soil is saturated during these periods, and roots are limited by the cemented and compacted layer in the soil.

Management practices:
- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- To reduce compaction and rutting, use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, queencup beadlily, starry false Solomon's seal, western rattlesnake plantain, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common prince's pine, big blueberry, shinyleaf spirea, goldthread, longtube twinflower, and common snowberry
Total production of air-dry vegetation (pounds per acre): 200

Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,400 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to erosion and slumping.
- Slope limits the use of the steeper areas of this unit for site development.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength when wet.
- Building sites, camp areas, and trails are limited by seasonal wetness.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.

Management practices:
- Design and construct buildings, roads, and septic tank absorption fields to compensate for slope in the steeper areas.
- In the steeper areas, reduce erosion by disturbing only the part of the site that is used for construction.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design and construct roads to offset the limited ability of the soil to support a load and frost action.
- Design and construct septic tank absorption fields to compensate for restricted soil permeability and perched water table.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads and trails to control surface runoff and stabilize cut-and-fill slopes.
- Design and construct buildings and roads to compensate for the seasonal perched water table.

Interpretive Groups

Capability class: VIe

37—Hobo-Helmer silt loams, extremely acid, 5 to 15 percent slopes, severely eroded

Composition

Hobo and similar soils: 45 percent
Helmer and similar soils: 40 percent
Contrasting inclusions: 15 percent

Hobo

Setting

Landscape position: Footslopes and terraces
Slope range: 5 to 15 percent
Slope features: Plane to convex
Elevation: 2,250 to 2,500 feet
Mean annual precipitation: 32 to 35 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

0 to 4 inches—pale brown silt loam, extremely acid, high concentrations of heavy metals
4 to 12 inches—very pale brown silt loam, very strongly acid
12 to 30 inches—very pale brown gravelly silt loam
30 to 42 inches—very pale brown very gravelly loam
42 to 60 inches—reddish yellow extremely cobbly silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks, with a thick mantle of volcanic ash
Permeability: Slow
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Severe to very severe
Depth to perched water table: 12 to 24 inches—February to April
Acidity: Extremely acid to very strongly acid in the surface layers

Helmer

Setting

Landscape position: Terraces and toeslopes
Slope range: 5 to 15 percent
Slope features: Plane to concave
Elevation: 2,250 to 2,500 feet
Mean annual precipitation: 32 to 35 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

0 to 0.5 inches—very dark brown surface crust, extremely acid, high concentrations of heavy metals
0.5 to 8 inches—light yellowish brown and very pale brown silt loam, extremely acid, high concentrations of heavy metals
8 to 18 inches—light yellowish brown and very pale brown silt loam
18 to 44 inches—very pale brown and light yellowish brown, dense, silt loam
44 to 60 inches—very pale brown, dense, cobbly silt loam

Soil Properties and Qualities

Depth class: Shallow to a fragipan
Drainage class: Moderately well drained
Parent material: Loess deposits overlying old alluvium, with a thick mantle of volcanic ash
Permeability: Very slow
Available water capacity: Low
Potential rooting depth: 12 to 20 inches
Rate of surface runoff: Rapid
Hazard of water erosion: Severe to very severe
Depth to perched water table: 12 to 18 inches—February to April
Acidity: Extremely acid to very strongly acid in the surface layers

Inclusions

Contrasting inclusions:
- Very strongly acid soils similar to Helmer soils but somewhat poorly drained in drainageways and depressions
- Soils similar to very strongly acid Hugus soils that are moderately well drained on convex slopes and escarpments
- Gullied land
- Dumps and mine tailings
- Udarents and slickens on randomly scattered areas

Use and Management

Major current uses:
- Mining activities
- Recreation
- Homesites

Vegetation

Trees suitable for planting: Austrian pine, western larch, ponderosa pine, and western white pine
Present vegetation: Small western white pine, quaking aspen, blue elderberry, serviceberry, redosier dogwood, Rocky Mountain maple, Columbia hawthorn, common snowberry, starry false Solomon's seal, oatgrass, hairy brackenfern, Utah honeysuckle, Indianhemp dogbane, field horsetail, and redtop
- The presence of heavy metals and extremely high soil acidity have drastically reduced the plant population, natural plant succession, and potential wood production. The normal habitat type is western hemlock/queencup beadlily.
- Approximately 35 percent of this unit is devoid of vegetation.

Management limitations:
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.
- Livestock grazing is not feasible on this unit due to lack of suitable forage vegetation and concentration of heavy metals.
- Seeding and planting are limited by the seasonal perched water table, restricted permeability, water erosion, and also restricted rooting depth on the Helmer soil.

Management practices:
- Toxic resistant plants must be used for erosion control plantings.
- Use plants and trees that tolerate high acidity and concentrations of heavy metals.
- Stabilize eroded areas before seeding and planting.
- The application of nitrogen fertilizer and other soil amendments is essential for plant establishment on this unit. Obtain a soil test for proper fertilizer management.
- Suitable topsoil may need to be brought in to establish a plant cover on highly toxic areas.

Building Site and Recreational Development

Management limitations:
- Seasonal wetness restricts building site and recreational development.

- Recreational development is limited by soil toxicity from heavy metals.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:
- Design and construct buildings and roads to compensate for seasonal wetness, frost action, and low soil strength.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design roads and trails to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Design and construct septic tank absorption fields to compensate for restricted soil permeability and the seasonal perched water table.
- Select adapted plants in establishing lawns, shrubs, trees, and gardens.
- Suitable topsoil may need to be brought in to replace toxic soil.

Interpretive Groups

Capability class: VIe

38—Honeyjones silt loam, 15 to 35 percent slopes

Composition

Honeyjones and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing mountain ridges and footslopes
Slope range: 15 to 35 percent
Slope features: Plane to convex
Elevation: 2,200 to 3,800 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—grayish brown silt loam
2 to 15 inches—yellowish brown silt loam and light yellowish brown gravelly silt loam
15 to 24 inches—very pale brown extremely cobbly loam
24 to 60 inches—very pale brown extremely stony loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight

Inclusions

Contrasting inclusions:
- Hugus soils on north-facing foothills and footslopes
- Ahrs soils on east- and west-facing mountain slopes
- Hobo soils on dissected terraces and footslopes
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 10A
Trees suitable for planting: Western white pine, grand fir, and Douglas-fir

Mean site index:
Western white pine—72 (50-year site curve)
Grand fir—98 (50-year site curve)
Douglas-fir—82 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—139 cubic feet at 105 years of age
Grand fir—149 cubic feet at 90 years of age
Douglas-fir—86 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western larch, western white pine, grand fir, Douglas-fir, queencup beadlily, goldthread, starry false Solomon's seal, and myrtle pachystima
Management limitations:
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.

Management practices:
- Use conventional methods in harvesting timber.

Grazeable Understory

Common forest understory plants: Longtube twinflower, goldthread, queencup beadlily, western rattlesnake plantain, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, myrtle pachystima, big blueberry, and shinyleaf spirea
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads, camp areas, and sanitary facilities to compensate for slope.
- Design and construct roads to compensate for large stones and frost action.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIe

39—Honeyjones silt loam, 35 to 75 percent slopes

Composition

Honeyjones and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Plane to convex
Elevation: 2,200 to 4,800 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—grayish brown silt loam
2 to 15 inches—yellowish brown silt loam and light yellowish brown gravelly silt loam
15 to 24 inches—very pale brown extremely cobbly loam
24 to 60 inches—very pale brown extremely stony loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Hugus soils on north-facing foothills
- Ahrs soils on east- and west-facing mountain slopes
- Soils similar to Honeyjones soils with bedrock at less than 60 inches on ridges and convex slopes
- Latour soils on north-facing mountain slopes at higher elevations
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Western white pine, grand fir, and Douglas-fir
Mean site index:
Western white pine—71 (50-year site curve)
Grand fir—86 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—137 cubic feet at 105 years of age
Grand fir—125 cubic feet at 100 years
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western larch, western white pine, grand fir, Douglas-fir, queencup beadlily, goldthread, starry false Solomon's seal, and myrtle pachystima
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Road failure and landslides may occur after road construction and clearcutting especially where the bedrock layers are parallel to the slope.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Because sliding and slumping can result if the soil is disturbed, use the kind of logging methods that disturb the soil least and stabilize cuts and fills.
- Roads built on 60 percent slopes or steeper should be full benched to prevent road failure.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.

Grazeable Understory

Common forest understory plants: Longtube twinflower, goldthread, queencup beadlily, western rattlesnake plantain, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, myrtle pachystima, big blueberry, and shinyleaf spirea
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Cut slopes generally are stable, but slumping and landslides can occur where the bedrock is highly fractured or where rock layers are parallel to the slope.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads to compensate for the steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Stabilize cutbanks to avoid slumping onto the roadway.

- Stabilize disturbed areas to reduce the risk of soil slippage and landslides.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIIe

40—Honeyjones gravelly silt loam, 65 to 85 percent slopes

Composition

Honeyjones and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: Very steep, north-facing mountain slopes and breaklands
Slope range: 65 to 85 percent
Slope features: Plane to convex
Elevation: 2,400 to 4,800 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—grayish brown gravelly silt loam
2 to 16 inches—yellowish brown and light yellowish brown gravelly silt loam
16 to 43 inches—pale brown extremely gravelly loam and extremely cobbly loam
43 to 60 inches—very pale brown extremely gravelly loam and extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Severe

Inclusions

Contrasting inclusions:
- Soils that are very gravelly in the surface layers on extremely steep, convex slopes
- Ahrs soils on east- and west-facing mountain slopes
- Soils that have fractured bedrock at depths of 40 to 60 inches on ridges
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Western white pine, grand fir, and Douglas-fir
Mean site index:
Western white pine—71 (50-year site curve)
Grand fir—86 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—137 cubic feet at 105 years of age
Grand fir—125 cubic feet at 100 years of age
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western larch, western white pine, grand fir, Douglas-fir, queencup beadlily, goldthread, starry false Solomon's seal, big blueberry, and myrtle pachystima

Management limitations:
- Using conventional methods harvesting timber is impossible because of the slope.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Road failure and landslides may occur after road construction and clearcutting.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Reduce the risk of erosion, soil slippage, and landslides by avoiding excessive disturbance on the soil.
- Roads must be full benched, and stabilization practices should include cross drains, rip rap below culvert outlets, slash windrows, seeding, mulching, and erosion blankets. Apply stabilization practices immediately after construction.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.

Building Site and Recreational Development

Management limitations:
- Extremely steep slopes prevent the use of this unit for building site and recreational development.
- Disturbing the soil increases the risk of erosion, soil slippage, and landslides.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion and slippage by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIIe

41—Honeyjones-Ahrs association, 15 to 35 percent slopes

Composition

Honeyjones and similar soils: 45 percent
Ahrs and similar soils: 35 percent
Contrasting inclusions: 20 percent

Honeyjones

Setting

Landscape position: North- and east-facing mountain slopes and ridges
Slope range: 15 to 35 percent
Slope features: Plane to convex
Elevation: 2,200 to 4,800 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—grayish brown silt loam
2 to 15 inches—yellowish brown silt loam and light yellowish brown gravelly silt loam
15 to 24 inches—very pale brown extremely cobbly loam
24 to 60 inches—very pale brown extremely stony loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight

Ahrs

Setting

Landscape position: South- and west-facing mountain slopes and ridges
Slope range: 15 to 35 percent
Slope features: Plane to convex
Elevation: 2,200 to 4,800 feet
Mean annual precipitation: 30 to 42 inches
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 6 inches—grayish brown gravelly silt loam
6 to 18 inches—yellowish brown very cobbly silt loam
18 to 30 inches—light yellowish brown extremely cobbly loam
30 to 60 inches—very pale brown extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight

Inclusions

Contrasting inclusions:
- Pinecreek soils on south-facing slopes
- Latour soils on north-facing slopes at higher elevations
- Hugus soils on north-facing slopes at lower elevations
- Soils that have bedrock at depths of 10 to 20 inches on ridges and knobs
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Honeyjones

Woodland suitability subclass: 10A
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Western white pine—72 (50-year site curve)
Grand fir—98 (50-year site curve)
Douglas-fir—82 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—139 cubic feet at 105 years of age
Grand fir—149 cubic feet at 90 years of age
Douglas-fir—86 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western larch, western white pine, grand fir, Douglas-fir, queencup beadlily, goldthread, starry false Solomon's seal, and myrtle pachystima

Ahrs

Woodland suitability subclass: 8A
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—78 (50-year site curve)
Western white pine—83 (50-year site curve)
Douglas-fir—77 (50-year site curve)
Ponderosa pine—105 (100-year site curve)
Estimated average annual production (CMAI):
Grand fir—110 cubic feet at 108 years of age
Western white pine—160 cubic feet at 100 years of age
Douglas-fir—75 cubic feet at 99 years of age
Ponderosa pine—112 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, western white pine, ponderosa pine, queencup beadlily, goldthread, and myrtle pachystima

Management limitations:
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation on the Ahrs soil.

Management practices:
- Use conventional methods in harvesting timber.
- Prepare the site carefully to control competing brushy vegetation on the Ahrs soil.

Grazeable Understory

Honeyjones

C*ommon forest understory plants:* Longtube twinflower, goldthread, queencup beadlily, western rattlesnake plantain, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, myrtle pachystima, big blueberry, and shinyleaf spirea
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Ahrs

Common forest understory plants: Columbia brome, longtube twinflower, queencup beadlily, goldthread, American trailplant, Piper's anemone, starry false Solomon's seal, Rocky Mountain maple, myrtle pachystima, common snowberry, baldhip rose, Saskatoon serviceberry, and white spirea
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production

ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Thick brush on the Ahrs soil can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Manage trees and shrubs on the Ahrs soil by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- The quality of roadbeds and road surfaces on the Honeyjones soil can be adversely affected by frost action.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct buildings and access roads to compensate for slope, large stones, and frost action.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIe

42—Honeyjones-Ahrs association, 35 to 75 percent slopes

Composition

Honeyjones and similar soils: 45 percent
Ahrs and similar soils: 35 percent
Contrasting inclusions: 20 percent

Honeyjones

Setting

Landscape position: North- and east-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Plane to convex
Elevation: 2,200 to 4,800 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—grayish brown silt loam
2 to 15 inches—yellowish brown silt loam and light yellowish brown gravelly silt loam
15 to 24 inches—very pale brown extremely cobbly loam
24 to 60 inches—very pale brown extremely stony loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Ahrs

Setting

Landscape position: South- and west-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Convex
Elevation: 2,200 to 4,800 feet
Mean annual precipitation: 30 to 42 inches
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 6 inches—grayish brown gravelly silt loam
6 to 18 inches—yellowish brown very cobbly silt loam
18 to 30 inches—light yellowish brown extremely cobbly loam
30 to 60 inches—very pale brown extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Pinecreek soils on south-facing slopes
- Hugus soils on north-facing slopes at lower elevations
- Latour soils on north-facing slopes at higher elevations
- Soils with bedrock at depths of 10 to 20 inches on ridges and knobs
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production (fig. 11)
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Figure 11.—An area of Honeyjones-Ahrs association, 35 to 75 percent slopes, used for timber production.

Woodland

Honeyjones

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Western white pine—71 (50-year site curve)
Grand fir—86 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—137 cubic feet at 105 years of age
Grand fir—125 cubic feet at 100 years of age
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western larch, western white pine, grand fir, Douglas-fir, queencup beadlily, goldthread, starry false Solomon's seal, and myrtle pachystima

Ahrs

Woodland suitability subclass: 8R
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—78 (50-year site curve)
Western white pine—83 (50-year site curve)
Ponderosa pine—105 (100-year site curve)
Douglas-fir—77 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—110 cubic feet at 108 years of age
Western white pine—160 cubic feet at 100 years of age
Ponderosa pine—112 cubic feet at 40 years of age
Douglas-fir—75 cubic feet at 99 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, western white pine, ponderosa pine, queencup beadlily, goldthread, and myrtle pachystima

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Road failure and landslides are likely to occur on the Honeyjones soil after road construction and clearcutting, especially where bedrock layers are parallel to the surface.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation on the Ahrs soil.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Because sliding and slumping can result if the Honeyjones soil is disturbed, use the kind of logging methods that disturb the soil least and stabilize cuts and fills.
- Roads built on 60 percent slopes or steeper should be full benched to prevent road failure.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully on the Ahrs soil to control competing brushy vegetation.

Grazeable Understory

Honeyjones

Common forest understory plants: Longtube twinflower, goldthread, queencup beadlily, western rattlesnake plantain, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, myrtle pachystima, big blueberry, and shinyleaf spirea
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Ahrs

Common forest understory plants: Columbia brome, longtube twinflower, queencup beadlily, goldthread, American trailplant, Piper's anemone, starry false Solomon's seal, Rocky Mountain maple, myrtle pachystima, common snowberry, baldhip rose, Saskatoon serviceberry, and white spirea
Total production of air-dry vegetation (pounds per acre): 250

Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Thick brush can invade on the Ahrs soil when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs on the Ahrs soil by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Cut slopes on the Honeyjones soil generally are stable, but slumping and landslides can occur where the bedrock is highly fractured or where rock layers are parallel to the slope.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Stabilize cutbanks on the Honeyjones soil to avoid slumping onto the roadway.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIIe

43—Honeyjones-Ahrs association, moderately acid, 35 to 75 percent slopes

Composition

Honeyjones and similar soils: 45 percent
Ahrs and similar soils: 40 percent
Contrasting inclusions: 15 percent

Honeyjones

Setting

Landscape position: North-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Plane to concave
Elevation: 3,200 to 4,400 feet
Mean annual precipitation: 35 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 4 inches—grayish brown and yellowish brown silt loam, moderately acid, moderate concentrations of heavy metals
4 to 16 inches—light yellowish brown gravelly silt loam
16 to 34 inches—pale brown extremely cobbly silt loam
34 to 60 inches—very pale brown extremely stony silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate
Acidity: Moderately acid in the surface layer

Ahrs

Setting

Landscape position: East- and west-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Convex
Elevation: 3,200 to 4,400 feet

Mean annual precipitation: 35 to 40 inches
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 4 inches—brown gravelly silt loam, moderately acid, moderate concentrations of heavy metals
4 to 18 inches—yellowish brown very cobbly silt loam
18 to 32 inches—light yellowish brown extremely cobbly silt loam
32 to 60 inches—very pale brown extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate
Acidity: Moderately acid in the surface layer

Inclusions

Contrasting inclusions:
- Very strongly acid Hugus soils on east- and west-facing slopes at lower elevations
- Very strongly acid, deep Tigley soils on south-facing slopes at lower elevations
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat

Woodland

Honeyjones, moderately acid

Woodland suitability subclass: 9R
Trees suitable for planting: Western white pine, western larch, and Douglas-fir
Mean site index:
Western white pine—70 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—135 cubic feet at 105 years of age
Dominant vegetation: Western white pine, western larch, lodgepole pine, Rocky Mountain maple, willow, queencup beadlily, myrtle pachystima, big blueberry, starry false Solomon's seal, bunchberry dogwood, pine reedgrass, millet woodrush, Columbia brome, goldthread, sidebells shinleaf, common prince's pine, and common snowberry
- The presence of heavy metals and higher than normal soil acidity have modified the normal plant succession. Normal habitat type is western hemlock/queencup beadlily.

Ahrs, moderately acid

Woodland suitability subclass: 9R
Trees suitable for planting: Western white pine, western larch, and Douglas-fir
Mean site index:
Western white pine—70 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—135 cubic feet at 105 years of age
Dominant vegetation: Western white pine, ponderosa pine, lodgepole pine, Rocky Mountain maple, willow, redstem ceanothus, myrtle pachystima, starry false Solomon's seal, Utah honeysuckle, queencup beadlily, pine reedgrass, redtop, queencup beadlily, Saskatoon serviceberry, creambush oceanspray, common snowberry, mallow ninebark, Indianhemp dogbane, and sedge
- The presence of heavy metals and higher than normal soil acidity has modified the normal plant succession. Normal habitat type is grand fir/queencup beadlily.
- Approximately 10 percent of this unit is devoid of vegetation.

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Road failure and landslides may occur after road construction and clearcutting where bedrock layers are parallel to the slope.
- When openings are made in the canopy on the Ahrs soil, invading brushy plants can delay natural reforestation.

- Moderate acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Roads built on 60 percent slopes or steeper should be full benched to prevent road failure.
- Prepare the site carefully on the Ahrs soil to control competing brushy vegetation.
- Use plants and trees that tolerate moderate acidity and concentrations of heavy metals.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation increases the risk of soil slippage and landslides where the bedrock layers are parallel to the slope.
- Plant cover may be affected by the acidity and concentrations of heavy metals.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope and large stones.
- Stabilize disturbed areas to reduce the risk of soil slippage and landslides where the bedrock layers are parallel to the slope.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Select adapted plants in establishing a plant cover.

Interpretive Groups

Capability class: VIIe

44—Honeyjones-Rock outcrop complex, 65 to 85 percent slopes

Composition

Honeyjones and similar soils: 50 percent
Rock outcrop: 25 percent
Contrasting inclusions: 25 percent

Honeyjones

Setting

Landscape position: North-facing mountain slopes and breaklands
Slope range: 65 to 85 percent
Slope features: Plane to convex very steep and extremely steep
Elevation: 2,200 to 3,800 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 41 to 45 degrees F
Frost-free period: 60 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—grayish brown gravelly silt loam
2 to 16 inches—yellowish brown and light yellowish brown gravelly silt loam
16 to 43 inches—pale brown extremely gravelly loam and extremely cobbly loam
43 to 60 inches—very pale brown extremely gravelly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite, with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Severe

Rock outcrop

Setting

Landscape position: Mountains and breaklands
- Rock outcrop consists of areas of exposed metasedimentary bedrock.
- Areas of rock outcrop are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Ahrs soils on south-, east-, and west-facing mountain slopes
- Soils with bedrock at depths of 10 to 20 inches on ridges
- Soils with more than 35 percent rock fragments in the surface layers on convex, north-facing mountain slopes
- Rubble land

Use and Management

Major current uses:
- Timber production
- Wildlife habitat
- Watershed

Woodland

Honeyjones

Woodland suitability subclass: 9R
Trees suitable for planting: Douglas-fir, grand fir, and western white pine
Mean site index:
Western white pine—71 (50-year site curve)
Grand fir—86 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—137 cubic feet at 105 years of age
Grand fir—125 cubic feet at 100 years of age
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western larch, western white pine, grand fir, Douglas-fir, queencup beadlily, goldthread, starry false Solomon's seal, and myrtle pachystima
Management limitations:
- Areas of rock outcrop reduce yield by about 25 percent.
- Using conventional methods in harvesting timber is impossible because of the slope.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion and soil slippage.
- Road failure and landslides may occur after road construction and clearcutting.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Areas of rock outcrop can interfere with logging and yarding operations and may cause breakage of timber.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Because sliding and slumping can result if the soil is disturbed, use the kind of logging methods that disturb the soil least and stabilize cuts and fills.
- Roads must be full benched, and stabilization practices should include cross drains, rip rap below culvert outlets, slash windrows, seeding, mulching, and erosion blankets. Apply stabilization practices immediately after construction. Permanent haul or traveled roads should be surfaced to reduce roadway erosion.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.

Building Site and Recreational Development

Management limitations:
- Steep slopes prevent the use of this unit for building site development.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class:
Honeyjones soil—VIIe
Rock outcrop—VIIIs

45—Hugus gravelly loam, very strongly acid, 30 to 65 percent slopes, severely eroded

Composition

Hugus and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: East- and west-facing foothills and dissected terrace escarpments
Slope range: 30 to 65 percent
Slope features: Concave to convex
Elevation: 2,250 to 3,400 feet
Mean annual precipitation: 32 to 38 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

0 to 6 inches—grayish brown gravelly loam, very strongly acid, high concentrations of heavy metals
6 to 22 inches—light yellowish brown very gravelly loam
22 to 46 inches—very pale brown extremely gravelly silty clay loam and extremely gravelly loam

46 to 60 inches—very pale brown extremely gravelly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Very rapid
Hazard of water erosion: Very severe
Acidity: Very strongly acid or extremely acid in the surface layer

Inclusions

Contrasting inclusions:
- Very strongly acid, deep Tigley soils on south-facing convex slopes
- Very strongly acid, eroded soils similar to Ahrs soils on east- and west-facing slopes at higher elevations
- Very strongly acid, eroded soils similar to Honeyjones soils on north-facing slopes
- Soils with very gravelly and extremely gravelly surfaces on extremely eroded convex slopes
- Areas of rock outcrop
- Gullied land

Use and Management

Major current uses:
- Mining activities
- Recreation

Vegetation

Trees suitable for planting: Ponderosa pine, western white pine, and Austrian pine
Present vegetation: Small western white pine, quaking aspen, Rocky Mountain maple, blue elderberry, serviceberry, brackenfern, Indianhemp dogbane, Utah honeysuckle, common snowberry, Scouler's willow, and redtop
- The presence of heavy metals and much higher than normal soil acidity have noticeably reduced the plant succession on this map unit. Normal habitat type is western hemlock/queencup beadlily.
- Approximately 50 percent of this unit is devoid of vegetation.

Management limitations:
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.
- Livestock grazing is not feasible on this unit due to steepness of slope, lack of suitable forage vegetation, and concentration of heavy metals.
- Seeding and planting are limited by steep slopes, seedling mortality, and water erosion.

Management practices:
- Use plants and trees that tolerate high acidity and concentrations of heavy metals.
- The application of nitrogen fertilizer and other soil amendments is essential for plant establishment on this unit. Obtain a soil test for proper fertilizer management.
- Stabilize eroded areas before seeding and planting.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Disturbing the soil increases the risk of erosion.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil create road hazards and increase maintenance costs.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Select plants adapted to high levels of soil acidity and high concentrations of heavy metals in establishing a plant cover.

Interpretive Groups

Capability class: VIIe

46—Hugus silt loam, 30 to 65 percent slopes

Composition

Hugus and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing foothills and dissected terrace slopes
Slope range: 30 to 65 percent
Slope features: Concave to plane

Elevation: 2,160 to 3,600 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 4 inches—pale brown silt loam
4 to 15 inches—light yellowish brown silt loam
15 to 52 inches—pale brown, very pale brown, and yellow very gravelly silt loam
52 to 60 inches—yellow extremely gravelly silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderately slow
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Tigley soils on south- and west-facing slopes
- Ahrs soils on south-facing convex slopes
- Honeyjones soils on north-facing slopes
- Hobo soils on less sloping toeslopes and terraces
- Areas of rock outcrop on convex slopes and ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir, western white pine, and Douglas-fir
Mean site index:
Grand fir—90 (50-year site curve)
Western white pine—76 (50-year site curve)
Western larch—77 (50-year site curve)
Douglas-fir—87 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—133 cubic feet at 96 years of age
Western white pine—146 cubic feet at 100 years of age
Western larch—116 cubic feet at 70 years of age
Douglas-fir—97 cubic feet at 92 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, wild ginger, queencup beadlily, and myrtle pachystima
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.

Grazeable Understory

Common forest understory plants: Goldthread, longtube twinflower, queencup beadlily, myrtle pachystima, wild ginger, Utah honeysuckle, Oregon fairybells, American trailplant, darkwoods violet, starry false Solomon's seal, bunchberry dogwood, oneleaf foamflower, and baldhip rose
Total production of air-dry vegetation (pounds per acre): 100
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads to compensate for the steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIIe

47—Hugus silt loam, high precipitation, 30 to 65 percent slopes

Composition

Hugus and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing foothills
Slope range: 30 to 65 percent
Slope features: Concave to plane
Elevation: 2,800 to 4,700 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 4 inches—pale brown silt loam
4 to 15 inches—light yellowish brown silt loam
15 to 52 inches—pale brown, very pale brown, and yellow very gravelly silt loam
52 to 60 inches—yellow extremely gravelly silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderately slow
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Bouldercreek, high precipitation soils on north-facing convex slopes
- Nakarna, high precipitation soils on foothills
- Floodwood soils on less sloping foothill slopes
- Vaywood, cold soils on higher elevation north-facing slopes
- Areas of rock outcrop on convex slopes and ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir, western white pine, and Douglas-fir
Mean site index:
Grand fir—90 (50-year site curve)
Western white pine—76 (50-year site curve)
Western larch—77 (50-year site curve)
Douglas-fir—87 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—133 cubic feet at 96 years
Western white pine—146 cubic feet at 100 years of age
Western larch—116 cubic feet at 70 years of age
Douglas-fir—97 cubic feet at 92 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, wild ginger, queencup beadlily, and myrtle pachystima
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.

- Constructing roads at midslope results in large cuts and fills which increase the risk of slumping.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.

Management practices:

- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Stabilize road cutbanks to avoid slumping onto roadways.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.

Grazeable Understory

Common forest understory plants: Goldthread, western rattlesnake plantain, longtube twinflower, starry false Solomon's seal, darkwoods violet, baldhip rose, queencup beadlily, myrtle pachystima, wild ginger, Utah honeysuckle, American trailplant, and Oregon fairybells

Total production of air-dry vegetation (pounds per acre): 100

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management limitations:

- Slope may cause livestock distribution problems.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Road cutbanks are subject to slumping.

Management practices:

- Design and construct roads and trails to compensate for the steepness of slope.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Stabilize cutbanks to avoid slumping onto the roadway.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIIe

48—Hugus gravelly silt loam, moderately acid, 30 to 65 percent slopes

Composition

Hugus and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: East- and west-facing foothills and dissected terrace escarpments
Slope range: 30 to 65 percent
Slope features: Concave to convex
Elevation: 2,400 to 3,400 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 4 inches—yellowish brown gravelly silt loam, moderately acid, moderate concentrations of heavy metals
4 to 14 inches—light yellowish brown gravelly silt loam
14 to 42 inches—light brown, yellow, and reddish yellow very gravelly silt loam and very gravelly loam
42 to 60 inches—yellow and very pale brown extremely gravelly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a thick mantle of volcanic ash

Permeability: Moderately slow
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Moderate
Acidity: Moderately acid in the surface layer

Inclusions

Contrasting inclusions:
- Strongly acid soils similar to Hugus soils on north-facing slopes at lower elevations
- Moderately acid Honeyjones soils on north-facing slopes at higher elevations
- Moderately acid Ahrs soils on east- and west-facing slopes at higher elevations
- Very strongly acid Tigley soils on south-facing slopes
- Strongly acid Hobo soils on less sloping terraces and hilltops

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat

Woodland

Woodland suitability subclass: 10R
Trees suitable for planting: Western white pine, western larch, and Douglas-fir
Mean site index:
Western white pine—78 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—150 cubic feet at 100 years of age
Present vegetation: Western white pine, western larch, lodgepole pine, Rocky Mountain maple, red alder, willow, queencup beadlily, myrtle pachystima, starry false Solomon's seal, Utah honeysuckle, redtop, white spirea, goldthread, Oregon fairybells, sweetscented bedstraw, bunchberry dogwood, oatgrass, and brackenfern
- The presence of heavy metals and higher than normal soil acidity have modified the normal plant succession. Normal habitat type is western hemlock/queencup beadlily.

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Moderate acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.

Management practices:
- Use high-lead or other cable logging that fully or partially suspend logs because it is less damaging to the soil.
- Use plants and trees that tolerate moderate acidity and concentrations of heavy metals.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope.
- Select adapted plants in establishing a plant cover.

Interpretive Groups

Capability class: VIIe

49—Hugus cobbly silt loam, very strongly acid, 30 to 65 percent slopes

Composition

Hugus and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: East- and west-facing foothills and dissected terrace escarpments
Slope range: 30 to 65 percent
Slope features: Concave to convex
Elevation: 2,250 to 3,400 feet
Mean annual precipitation: 32 to 38 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—0.5-inch thick
0 to 4 inches—brown cobbly silt loam, very strongly acid, high concentrations of heavy metals
4 to 9 inches—yellowish brown cobbly silt loam
9 to 13 inches—light brown very gravelly silt loam
13 to 42 inches—reddish yellow and pink very gravelly silt loam and very gravelly loam
42 to 60 inches—pink extremely gravelly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate
Acidity: Very strongly acid in the surface layer

Inclusions

Contrasting inclusions:
- Strongly acid soils similar to Hugus soils on north-facing slopes
- Moderately acid Ahrs soils on southeast- and southwest-facing slopes at higher elevations
- Very strongly acid Tigley soils on south-facing slopes and ridges
- Very strongly acid Hobo soils on less sloping terraces

Use and Management

Major current uses:
- Mining activities
- Wildlife habitat
- Recreation

Vegetation

Trees suitable for planting: Ponderosa pine, western white pine, and Austrian pine
Present vegetation: Small western white pine and ponderosa pine, redtop, brackenfern, Rocky Mountain maple, willow, blue elderberry, serviceberry, starry false Solomon's seal, bunchberry dogwood, Utah honeysuckle, low Oregongrape, common snowberry, queencup beadlily, and Indianhemp dogbane
- The presence of heavy metals and very high soil acidity have severely reduced natural plant succession and potential wood production. Normal habitat type is western hemlock/queencup beadlily.
- Approximately 25 percent of this unit is devoid of vegetation.

Management limitations:
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.
- Livestock grazing is not feasible on this unit due to steepness of slope, lack of suitable forage vegetation, and concentration of heavy metals.
- Seeding and planting are limited by steep slopes and seedling mortality.

Management practices:
- Use plants and trees that tolerate high acidity and concentrations of heavy metals.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope.
- Select plants adapted to high levels of soil acidity and high concentrations of heavy metals in establishing a plant cover.

Interpretive Groups

Capability class: VIIe

50—Jacot silt loam, 35 to 65 percent slopes

Composition

Jacot and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: Foothills
Slope range: 35 to 65 percent
Slope features: Plane to convex
Elevation: 2,200 to 4,400 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 4 inches—pale brown silt loam
4 to 14 inches—light yellowish brown silt loam
14 to 40 inches—very pale brown and pale yellow gravelly sandy loam
40 to 48 inches—pale yellow gravelly loamy sand
48 to 60 inches—pale yellow very gravelly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Weathered material derived from gneiss or granitic bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and severe in subsoil

Inclusions

Contrasting inclusions:
- Blackprince soils on south-facing slopes at lower elevations
- Garveson soils on north-facing convex slopes
- Hugus soils on northeast- and northwest-facing concave slopes
- Kruse soils on southeast- and southwest-facing concave slopes
- Hobo soils on north-, east-, and west-facing toeslopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 8R
Trees suitable for planting: Western white pine, grand fir, and western larch
Mean site index:
Western white pine—75 (50-year site curve)
Western larch—70 (50-year site curve)
Grand fir—80 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—144 cubic feet at 100 years of age
Western larch—101 cubic feet at 70 years of age
Grand fir—114 cubic feet at 107 years of age
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, starry false Solomon's seal, and longtube twinflower

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Road cutbanks are occasionally subject to caving.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Adequately designed road drainage reduces the risk of gully erosion on the roadway.
- Stabilize road cutbanks to avoid the hazard of caving.

Grazeable Understory

Common forest understory plants: Western rattlesnake plantain, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common snowberry, big blueberry, shinyleaf spirea, goldthread, starry false Solomon's seal, common prince's pine, longtube twinflower, myrtle pachystima, and queencup beadlily
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to caving.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope.
- Design access roads to control surface runoff on the roadway.

- Excavations should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

51—Jacot-Blackprince complex, 35 to 65 percent slopes

Composition

Jacot and similar soils: 50 percent
Blackprince and similar soils: 30 percent
Contrasting inclusions: 20 percent

Jacot

Setting

Landscape position: North-facing slopes of foothills
Slope range: 35 to 65 percent
Slope features: Concave to plane
Elevation: 2,200 to 4,000 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 4 inches—pale brown silt loam
4 to 14 inches—light yellowish brown silt loam
14 to 40 inches—very pale brown and pale yellow gravelly sandy loam
40 to 48 inches—pale yellow gravelly loamy sand
48 to 60 inches—pale yellow very gravelly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from gneiss or granitic bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and severe in subsoil

Blackprince

Setting

Landscape position: South-facing slopes of foothills and canyonsides
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,200 to 4,000 feet
Mean annual precipitation: 30 to 38 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown gravelly sandy loam
3 to 11 inches—pale brown gravelly sandy loam
11 to 22 inches—very pale brown very gravelly coarse sandy loam
22 to 28 inches—variegated very gravelly loamy coarse sand
28 inches—weathered granitic bedrock

Soil Properties and Qualities

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Parent material: Weathered material derived from gneiss or granitic bedrock with minor amounts of loess and volcanic ash in the upper part
Permeability: Moderately rapid in the upper part and rapid below to soft bedrock
Available water capacity: Very low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Severe gully erosion

Inclusions

Contrasting inclusions:
- Lotuspoint soils on south-facing slopes
- Kruse soils on east- and west-facing concave slopes
- Soils on south-facing convex slopes and flatter ridges that have soft bedrock at depths of less than 20 inches
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Jacot

Woodland suitability subclass: 8R
Trees suitable for planting: Western white pine, western larch, and grand fir
Mean site index:
Western white pine—75 (50-year site curve)
Western larch—70 (50-year site curve)
Grand fir—80 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—144 cubic feet at 100 years of age
Western larch—101 cubic feet at 70 years of age
Grand fir—114 cubic feet at 107 years of age
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, starry false Solomon's seal, and longtube twinflower

Blackprince

Woodland suitability subclass: 7R
Trees suitable for planting: Douglas-fir and ponderosa pine
Mean site index:
Douglas-fir—74 (50-year site curve)
Grand fir—73 (50-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—69 cubic feet at 101 years of age
Grand fir—100 cubic feet at 111 years
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, ponderosa pine, western larch, pine reedgrass, mallow ninebark, creambush oceanspray, and common snowberry

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Road cutbanks are occasionally subject to caving.
- The deep cuts needed to level the road surface can expose soft bedrock on the Blackprince soil; however, it can be easily excavated.
- When openings are made in the canopy on the Blackprince soil, invading brushy plants can delay natural reforestation.
- Reforestation on the Blackprince soil is difficult on the hotter, drier, south-facing slopes because of droughtiness.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Adequately designed road drainage reduces the risk of gully erosion on the roadway.
- Stabilize road cutbanks to avoid the hazard of caving.
- Leave some of the larger trees on the Blackprince soil to provide shade for seedlings.
- Prepare the site carefully to control competing brushy vegetation on the Blackprince soil.

Grazeable Understory

Jacot

Common forest understory plants: Longtube twinflower, goldthread, starry false Solomon's seal, western rattlesnake plantain, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common snowberry, big blueberry, shinyleaf spirea, common prince's pine, myrtle pachystima, and queencup beadlily
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Blackprince

Common forest understory plants: Pine reedgrass, American trailplant, mallow ninebark, elk sedge, Columbia brome, strawberry, sweetscented bedstraw, Rocky Mountain maple, white spirea, creambush oceanspray, baldhip rose, and common snowberry
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Thick brush can invade on the Blackprince soil

when the canopy is opened and may limit forage and access by livestock.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs on the Blackprince soil by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to caving.
- The deep cuts needed to level the road surface can expose soft bedrock on the Blackprince soils; however, it can be easily excavated.

Management practices:

- Design and construct roads and trails to compensate for the steepness of slope.
- Design access roads to control surface runoff on the roadway.
- Excavations should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

52—Jacot-Garveson silt loams, 15 to 35 percent slopes

Composition

Jacot and similar soils: 45 percent
Garveson and similar soils: 35 percent
Contrasting inclusions: 20 percent

Jacot

Setting

Landscape position: Foothills
Slope range: 15 to 35 percent
Slope features: Plane to concave
Elevation: 2,600 to 4,400 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 4 inches—pale brown silt loam
4 to 14 inches—light yellowish brown silt loam
14 to 40 inches—very pale brown and pale yellow gravelly sandy loam
40 to 48 inches—pale yellow gravelly loamy sand
48 to 60 inches—pale yellow very gravelly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from gneiss or granitic bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight in surface layers and moderate gully erosion in subsoil and substratum

Garveson

Setting

Landscape position: Foothills
Slope range: 15 to 35 percent
Slope features: Plane to convex
Elevation: 2,600 to 4,400 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—brown silt loam
2 to 16 inches—yellowish brown and light yellowish brown silt loam
16 to 23 inches—pale brown very gravelly loamy coarse sand
23 to 60 inches—very pale brown and variegated very gravelly loamy coarse sand and very gravelly coarse sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Weathered material derived from granitic bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight in surface layers and moderate gully erosion in subsoil and substratum

Inclusions

Contrasting inclusions:
- Keeler soils on south-, east-, and west-facing slopes
- Nakarna soils on north-facing convex slopes
- Kruse soils on south-facing slopes
- Helmer soils on concave toeslopes and terraces
- Bouldercreek soils on north-facing slopes and canyonsides

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Homesites

Woodland

Jacot

Woodland suitability subclass: 9A
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Western white pine—75 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Western larch—70 (50-year site curve)
Grand fir—88 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—144 cubic feet at 100 years of age
Douglas-fir—83 cubic feet at 96 years of age
Western larch—101 cubic feet at 70 years of age
Grand fir—129 cubic feet at 98 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, starry false Solomon's seal, and longtube twinflower

Garveson

Woodland suitability subclass: 6A
Trees suitable for planting: Grand fir and western white pine
Mean site index:
Grand fir—67 (50-year site curve)
Douglas-fir—61 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—89 cubic feet at 115 years of age
Douglas-fir—46 cubic feet at 109 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, starry false Solomon's seal, and longtube twinflower

Management limitations:
- Road cutbanks are occasionally subject to caving.
- Steep logging roads, yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use conventional equipment when harvesting timber.
- Adequately designed road drainage reduces the risk of gully erosion on the roadway.
- Stabilize road cutbanks to avoid the hazard of caving.

Grazeable Understory

Common forest understory plants: Longtube twinflower, western rattlesnake plantain, starry false Solomon's seal, common prince's pine, myrtle pachystima, darkwoods violet, bunchberry dogwood, common snowberry, big blueberry, shinyleaf spirea, goldthread, oneleaf foamflower, and queencup beadlily
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,100 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.

- Slope limits the use of the steeper areas of this unit for site development.
- Cutbanks can cave because of the sandy substratum.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- Steep unsurfaced access roads are subject to rilling and gullying.
- The risk of seepage and the hazard of polluting the water supply limit the use of this unit as a septic tank absorption field.

Management practices:

- Design and construct buildings and roads to compensate for slope and frost action.
- Excavations should be designed to prevent cutbanks from caving.
- Design access roads to control surface runoff on the roadway.
- Design and construct septic tank absorption fields to compensate for slope and the hazard of seepage.

Interpretive Groups

Capability class: VIe

53—Jacot-Garveson silt loams, 35 to 65 percent slopes

Composition

Jacot and similar soils: 45 percent
Garveson and similar soils: 35 percent
Contrasting inclusions: 20 percent

Jacot

Setting

Landscape position: Foothills
Slope range: 35 to 65 percent
Slope features: Concave to plane
Elevation: 2,600 to 4,400 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 4 inches—pale brown silt loam
4 to 14 inches—light yellowish brown silt loam
14 to 40 inches—very pale brown and pale yellow gravelly sandy loam
40 to 48 inches—pale yellow gravelly loamy sand
48 to 60 inches—pale yellow very gravelly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from gneiss or granitic bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and severe gully erosion in subsoil and substratum

Garveson

Setting

Landscape position: Foothills
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,600 to 4,400 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 2 inches—brown silt loam
2 to 16 inches—yellowish brown and light yellowish brown silt loam
16 to 23 inches—pale brown very gravelly loamy coarse sand
23 to 60 inches—very pale brown and variegated very gravelly loamy coarse sand and very gravelly coarse sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from granitic bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and severe gully erosion in subsoil and substratum

Inclusions

Contrasting inclusions:
- Keeler soils on south-, east-, and west-facing slopes
- Nakarna soils on north-facing convex slopes and ridges
- Kruse soils on south-facing slopes
- Bouldercreek soils on north-facing slopes and canyonsides
- Marblecreek soils on south-facing convex slopes and ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Jacot

Woodland suitability group: 8R
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Western white pine—75 (50-year site curve)
Grand fir—80 (50-year site curve)
Western larch—70 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—144 cubic feet at 100 years of age
Grand fir—114 cubic feet at 107 years of age
Western larch—101 cubic feet at 70 years of age
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, starry false Solomon's seal, and longtube twinflower

Garveson

Woodland suitability group: 6R
Trees suitable for planting: Grand fir and western white pine
Mean site index:
Grand fir—67 (50-year site curve)
Douglas-fir—61 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—89 cubic feet at 115 years of age
Douglas-fir—46 cubic feet at 109 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, goldthread, starry false Solomon's seal, and longtube twinflower

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Road cutbanks are occasionally subject to caving.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion and slumping.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Stabilize road cutbanks to avoid the hazard of caving.
- Adequately designed road drainage reduces the risk of gully erosion on the roadway.

Grazeable Understory

Common forest understory plants: Starry false Solomon's seal, longtube twinflower, goldthread, queencup beadlily, bunchberry dogwood, common prince's pine, common snowberry, myrtle pachystima, big blueberry, shinyleaf spirea, darkwoods violet, western rattlesnake plantain, and oneleaf foamflower
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,100 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.

- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to caving and slumping.

Management practices:

- Design and construct roads and trails to compensate for the steepness of slope.
- Design access roads to control surface runoff on the roadway.
- Stabilize cutbanks to avoid caving and slumping onto the roadway.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

54—Joebaldy-Rubble land association, 10 to 50 percent slopes

Composition

Joebaldy and similar soils: 50 percent
Rubble land: 30 percent
Contrasting inclusions: 20 percent

Joebaldy

Setting

Landscape position: High elevation mountaintops and ridges (fig. 12)
Slope range: 10 to 50 percent
Slope features: Convex
Elevation: 5,200 to 6,300 feet
Mean annual precipitation: 45 to 55 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—0.5-inch thick
0 to 10 inches—dark gray and dark grayish brown stony silt loam
10 to 28 inches—brown and light yellowish brown very stony silt loam
28 to 60 inches—pebbles, cobbles, and stones

Soil Properties and Qualities

Depth class: Moderately deep to angular rock fragments
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Talus and colluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and very rapid below
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Medium
Hazard of water erosion: Moderate

Rubble Land

Setting

Landscape position: Mountaintops and ridges

- Rubble land consists of areas of stones and boulders that support little or no vegetation.
- Areas of rubble land are not suitable for most land uses.

Inclusions

Contrasting inclusions:

- Latour soils at lower elevations
- Honeyjones soils on north-facing slopes at lower elevations
- Ahrs soils on south-facing slopes at lower elevations
- Areas of rock outcrop

Use and Management

Major current uses:

- Wildlife habitat
- Recreation
- Watershed

Potential uses:

- Livestock grazing

Grazeable Understory

Common vegetation: Scattered whitebark pine and subalpine fir, common beargrass, green fescue, sedge, Columbia brome, Sitka mountain ash, common yarrow, and big blueberry
Total production of air-dry vegetation (pounds per acre): 1,000 to 1,200
Management limitations:

- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.
- The production of forage is limited by areas of rubble land, which generally interfere with the movement of livestock and limit the accessibility of forage.

Figure 12.—An area of Joebaldy-Rubble land association, 10 to 50 percent slopes, on high elevation mountain ridges.

Management practices:

- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of the steeper areas of this unit for site development.
- Rubble land may interfere with the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.

Management practices:

- Design and construct roads, trails, and camp areas to compensate for the steepness of slope, large stones, and areas of rubble land.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class:
Joebaldy soil—VIe
Rubble land—VIIIs

55—Keeler complex, 30 to 55 percent slopes

Composition

Keeler, warm and similar soils: 45 percent
Keeler and similar soils: 35 percent
Contrasting inclusions: 20 percent

Keeler, warm

Setting

Landscape position: South-facing slopes of foothills
Elevation: 2,800 to 3,200 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 100 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—pale brown silt loam
5 to 16 inches—light yellowish brown silt loam
16 to 36 inches—very pale brown silt loam and loam
36 to 60 inches—very pale brown and reddish yellow sandy loam and sandy clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from granite with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Very severe

Keeler

Setting

Landscape position: North-facing slopes of foothills
Slope range: 30 to 55 percent
Slope features: Concave to convex
Elevation: 2,800 to 3,200 feet

Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—pale brown silt loam
5 to 16 inches—light yellowish brown silt loam
16 to 36 inches—very pale brown silt loam and loam
36 to 60 inches—very pale brown and reddish yellow sandy loam and sandy clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from granite with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Very severe

Inclusions

Contrasting inclusions:
- Helmer soils on concave toeslopes
- Jacot soils on north-facing slopes
- Garveson soils on south-facing slopes
- Areas of rock outcrop on ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed
- Homesites

Woodland

Keeler, warm

Woodland suitability subclass: 9R
Trees suitable for planting: Western white pine, grand fir, and western larch
Mean site index:
Western white pine—80 (50-year site curve)
Grand fir—88 (50-year site curve)
Western larch—71 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—154 cubic feet at 100 years of age
Grand fir—129 cubic feet at 98 years of age
Western larch—103 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white

pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, starry false Solomon's seal, goldthread, and longtube twinflower

Keeler

Woodland suitability subclass: 10R
Trees suitable for planting: Western white pine, grand fir, and western larch
Mean site index:
Western white pine—78 (50-year site curve)
Grand fir—97 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—150 cubic feet at 100 years of age
Grand fir—147 cubic feet at 91 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, starry false Solomon's seal, goldthread, and longtube twinflower
Management limitations:
- Slope limits the kinds of equipment that can be used in forest management.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.

Management practices:
- On steeper slopes, use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.

Grazeable Understory

Keeler, warm

Common forest understory plants: Longtube twinflower, goldthread, oneleaf foamflower, starry false Solomon's seal, western rattlesnake plantain, darkwoods violet, common snowberry, baldhip rose, Utah honeysuckle, Columbia brome, queencup beadlily, common prince's pine, and dampwoods blueberry
Total production of air-dry vegetation (pounds per acre): 200

Keeler

Common forest understory plants: Longtube twinflower, western rattlesnake plantain, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, common snowberry, goldthread, myrtle pachystima, bunchberry dogwood, queencup beadlily, common prince's pine, big blueberry, and shinyleaf spirea
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,200 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steeper slopes.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.

Management practices:
- Design and construct buildings, sanitary facilities, camp areas, and access roads to compensate for the steepness of slope.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Reduce the risk of erosion on steep cut-and-fill slopes by establishing a plant cover on them.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIIe

56—Keeler-Jacot silt loams, 30 to 55 percent slopes

Composition

Keeler and similar soils: 50 percent
Jacot and similar soils: 30 percent
Contrasting inclusions: 20 percent

Keeler

Setting

Landscape position: North-, east-, and west-facing slopes of foothills
Slope range: 30 to 55 percent
Slope features: Concave
Elevation: 2,800 to 3,400 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 5 inches—pale brown silt loam
5 to 16 inches—light yellowish brown silt loam
16 to 36 inches—very pale brown silt loam and loam
36 to 60 inches—very pale brown and reddish yellow sandy loam and sandy clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from granite with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Very severe

Jacot

Setting

Landscape position: South-, east-, and west-facing slopes of foothills
Slope range: 30 to 55 percent
Slope features: Convex
Elevation: 2,800 to 3,400 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 80 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 4 inches—pale brown silt loam
4 to 14 inches—light yellowish brown silt loam
14 to 40 inches—very pale brown and pale yellow gravelly sandy loam
40 to 48 inches—pale yellow gravelly loamy sand
48 to 60 inches—pale yellow very gravelly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from gneiss or granitic bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and severe in subsoil

Inclusions

Contrasting inclusions:
- Helmer soils on concave toeslopes
- Nakarna soils on convex north-facing slopes
- Kruse soils on concave south-facing slopes
- Garveson soils on convex south-facing slope

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed
- Homesites

Woodland

Keeler

Woodland suitability subclass: 10R
Trees suitable for planting: Western white pine, grand fir, and western larch
Mean site index:
Western white pine—78 (50-year site curve)
Grand fir—97 (50-year site curve)

Estimated average annual production (CMAI):
Western white pine—150 cubic feet at 100 years of age
Grand fir—147 cubic feet at 91 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, starry false Solomon's seal, goldthread, and longtube twinflower

Jacot

Woodland suitability subclass: 8R
Trees suitable for planting: Western white pine, grand fir, and western larch
Mean site index:
Western white pine—75 (50-year site curve)
Grand fir—80 (50-year site curve)
Western larch—70 (50-year site curve)
Douglas-fir—81 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—144 cubic feet at 100 years of age
Grand fir—114 cubic feet at 107 years of age
Western larch—101 cubic feet at 70 years of age
Douglas-fir—83 cubic feet at 96 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, queencup beadlily, starry false Solomon's seal, goldthread, and longtube twinflower

Management limitations:
- Slope in steeper areas limits the kinds of equipment that can be used in forest management.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Road cutbanks on the Jacot soil are occasionally subject to caving.

Management practices:
- On steeper slopes, use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks on the Jacot soil to avoid the hazard of caving.

Grazeable Understory

Common forest understory plants: Longtube twinflower, goldthread, queencup beadlily, western rattlesnake plantain, starry false Solomon's seal, oneleaf foamflower, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, myrtle pachystima, big blueberry, and shinyleaf spirea
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,200 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steeper slopes.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks on the Jacot soil are subject to caving.
- The hazard of seepage on the Jacot soil may cause contamination of nearby streams from sanitary facilities.

Management practices:
- Design and construct buildings, camp areas, trails, and access roads to compensate for the steepness of slope.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.

- Reduce the risk of erosion on steep cut-and-fill slopes by establishing a plant cover on them.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Design and construct sanitary facilities to compensate for slope and the hazard of seepage on the Jacot soil.
- Excavations on the Jacot soil should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.
- Because of the risk of seepage on the Jacot soil, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

57—Kruse fine gravelly silt loam, 35 to 65 percent slopes

Composition

Kruse and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Position on landscape: South-, east-, and west-facing foothills and mountain slopes
Slope range: 35 to 65 percent
Slope features: Concave, steep and very steep
Elevation: 2,400 to 3,400 feet
Mean annual precipitation: 28 to 35 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 120 days

Typical Profile

Organic mat—1.5-inches thick
0 to 4 inches—brown fine gravelly silt loam
4 to 15 inches—pale brown fine gravelly silt loam
15 to 52 inches—very pale brown and yellow fine gravelly loam and fine gravelly sandy clay loam
52 to 60 inches—yellow fine gravelly sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from granite, gneiss, and schist with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow in the upper part and moderately rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Severe

Inclusions

Contrasting inclusions:
- Blackprince soils on east- and west-facing convex slopes
- Blackprince, warm soils on south-facing convex slopes and ridges
- Tigley soils on east- and west-facing slopes at lower elevations
- Hugus soils on north-facing slopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 12R
Trees suitable for planting: Douglas-fir, grand fir, and ponderosa pine
Mean site index:
Western white pine—102 (50-year site curve)
Douglas-fir—100 (50-year site curve)
Ponderosa pine—132 (100-year site curve)
Estimated average annual production (CMAI):
Western white pine—170 cubic feet at 90 years of age
Douglas-fir—130 cubic feet at 79 years of age
Ponderosa pine—170 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Grand fir, western white pine, Douglas-fir, ponderosa pine, western larch, lodgepole pine, mallow ninebark, creambush oceanspray, and common snowberry

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:

- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Elk sedge, pine reedgrass, Columbia brome, Rocky Mountain maple, mallow ninebark, creambush oceanspray, strawberry, common snowberry, American trailplant, sweetscented bedstraw, baldhip rose, and white spirea

Total production of air-dry vegetation (pounds per acre): 250

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:

- Slope may cause livestock distribution problems.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.

Management practices:

- Design and construct roads and trails to compensate for the steepness of slope.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Reduce the risk of erosion on steep cut-and-fill slopes by establishing a plant cover on them.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIIe

58—Lacy-Bobbitt stony loams, 35 to 65 percent slopes

Composition

Lacy and similar soils: 45 percent
Bobbitt and similar soils: 30 percent
Contrasting inclusions: 25 percent

Lacy

Setting

Landscape position: South-facing canyonsides and escarpments
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,150 to 3,200 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 100 to 130 days

Typical Profile

Organic mat—0.25-inch thick
0 to 11 inches—brown stony loam
11 to 18 inches—brown very cobbly clay loam
18 inches—hard, fractured basalt bedrock

Soil Properties and Qualities

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from basalt with a mantle of loess
Permeability: Moderately slow
Available water capacity: Very low
Potential rooting depth: 10 to 20 inches

Rate of surface runoff: Very rapid
Hazard of water erosion: Severe

Bobbitt

Setting

Landscape position: South-facing canyonsides and escarpments
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,150 to 3,200 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 47 to 49 degrees F
Frost-free period: 100 to 130 days

Typical Profile

Organic mat—2-inches thick
0 to 12 inches—brown stony loam
12 to 32 inches—brown and pale brown very cobbly clay loam
32 inches—hard, fractured basalt bedrock

Soil Properties and Qualities

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from basalt with a mantle of loess
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Very rapid
Hazard of water erosion: Severe

Inclusions

Contrasting inclusions:
- Agatha soils on east- and west-facing escarpments and canyonsides
- Lotuspoint soils on south-facing mountainsides and breaklands
- Areas of rock outcrop on convex slopes and ridges

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Lacy

Woodland suitability subclass: 5R
Trees suitable for planting: Ponderosa pine
Mean site index:
Ponderosa pine—80 (100-year site curve)
Estimated average annual production (CMAI):
Ponderosa pine—69 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Ponderosa pine, Idaho fescue, and bluebunch wheatgrass

Bobbitt

Woodland suitability subclass: 9R
Trees suitable for planting: Ponderosa pine
Mean site index:
Douglas-fir—71 (50-year site curve)
Ponderosa pine—115 (100-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—63 cubic feet at 102 years of age
ponderosa pine—130 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Douglas-fir, ponderosa pine, common snowberry, bluebunch wheatgrass, and pine reedgrass

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- Because roots are restricted by hard bedrock, trees are subject to windthrow on the Lacy soil.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Reforestation is difficult on the hotter, drier, south-facing slopes because of droughtiness.
- When building logging roads, the deep cuts needed to level the road surface can expose hard bedrock that is difficult to excavate.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Leave some of the larger trees to provide shade for seedlings.

- Design and construct logging roads to compensate for limited depth to bedrock.

Grazeable Understory

Lacy

Common forest understory plants: Idaho fescue, bluebunch wheatgrass, prairie junegrass, pine reedgrass, elk sedge, big bluegrass, arrowleaf balsamroot, lupine, sticky geranium, cinquefoil, threeflower avens, common snowberry, and Woods' rose
Total production of air-dry vegetation (pounds per acre): 900

Bobbitt

Common forest understory plants: Bluebunch wheatgrass, common snowberry, elk sedge, heartleaf arnica, pine reedgrass, rose, spreading sweetroot, strawberry, western fescue, and white spirea
Total production of air-dry vegetation (pounds per acre): 900
Livestock grazing:
- This unit can produce forage for livestock and big game animals on both soils for 15 to 25 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 900 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Excavation increases the risk of water erosion.
- Excavation is hampered by stones and cobbles in the soil and the limited depth to bedrock.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope, large stones, and limited depth to bedrock.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.

Interpretive Groups

Capability class: VIIe

59—Lacy-Rock outcrop complex, 35 to 65 percent slopes

Composition

Lacy and similar soils: 55 percent
Rock outcrop: 35 percent
Contrasting inclusions: 10 percent

Lacy

Setting

Landscape position: South-facing canyonsides and escarpments (fig. 13)
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,125 to 3,200 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 100 to 140 days

Typical Profile

Organic mat—0.25-inch thick
0 to 11 inches—brown stony loam
11 to 18 inches—brown very cobbly clay loam
18 inches—hard, fractured basalt bedrock

Soil Properties and Qualities

Depth class: Shallow (10 to 20 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from basalt with a mantle of loess
Permeability: Moderately slow
Available water capacity: Very low

Figure 13.—An area of Lacy-Rock outcrop complex, 35 to 65 percent slopes, on canyonsides. Agatha stony loam, 5 to 35 percent slopes, is on the flatter tops.

Potential rooting depth: 10 to 20 inches
Rate of surface runoff: Very rapid
Hazard of water erosion: Severe

Rock outcrop

Setting

Landscape position: Canyonsides and escarpments
- Rock outcrop consists of areas of exposed basalt bedrock.
- Areas of rock outcrop are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Bobbitt soils on south-facing escarpments and canyonsides
- Agatha soils on east- and west-facing escarpments and canyonsides

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Lacy

Woodland suitability subclass: 5R
Trees suitable for planting: Ponderosa pine
Mean site index:
Ponderosa pine—80 (100-year site curve)
Estimated average annual production (CMAI):
Ponderosa pine—69 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Ponderosa pine, Idaho fescue, and bluebunch wheatgrass
Management limitations:
- Areas of rock outcrop reduce yield about 35 percent.
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- Areas of rock outcrop can interfere with logging and yarding operations and may cause breakage of timber.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Reforestation is difficult on the hotter, drier, south-facing slopes because of droughtiness.
- Because roots are restricted by hard bedrock, trees are subject to windthrow.
- When building logging roads, the deep cuts needed to level the road surface can expose hard bedrock that is difficult to excavate.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Leave some of the larger trees to provide shade for seedlings.
- Design and construct logging roads to compensate for limited depth to bedrock and areas of rock outcrop.

Grazeable Understory

Common forest understory plants: Idaho fescue, bluebunch wheatgrass, prairie junegrass, pine reedgrass, elk sedge, big bluegrass, arrowleaf balsamroot, lupine, sticky geranium, cinquefoil, threeflower avens, common snowberry, and Woods' rose.
Total production of air-dry vegetation (pounds per acre): 900
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 15 to 25 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 900 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Areas of rock outcrop reduce yields about 35 percent.
- The production of forage is limited by the areas of rock outcrop, which generally interfere with the movement of livestock and limit the accessibility of forage.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Excavation increases the risk of water erosion.
- Excavation is hampered by stones and cobbles in the soil and the limited depth to bedrock.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Areas of rock outcrop in some areas may interfere with the use of construction equipment.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope, large stones, limited depth to bedrock, and areas of rock outcrop.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.

Interpretive Groups

Capability class:
Lacy—VIIe
Rock outcrop—VIIIs

60—Latour gravelly silt loam, 15 to 35 percent slopes

Composition

Latour and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-, east-, and west-facing mountain slopes and ridges; south-facing slopes at high elevations
Slope range: 15 to 35 percent
Slope features: Concave to convex
Elevation: 4,800 to 6,200 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—grayish brown gravelly silt loam
2 to 18 inches—yellowish brown gravelly silt loam and light yellowish brown very gravelly silt loam
18 to 42 inches—light yellowish brown extremely cobbly silt loam
42 to 60 inches—light yellowish brown extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Talus and colluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight

Inclusions

Contrasting inclusions:
- Joebaldy soils on south-facing slopes at higher elevations
- Ahrs soils on south-facing slopes at lower elevations
- Honeyjones soils on north-facing slopes at lower elevations
- Soils similar to Latour soils with bedrock at less than 60 inches on convex slopes
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed

Potential uses:
- Livestock grazing

Woodland

Woodland suitability subclass: 7A
Trees suitable for planting: Subalpine fir and Engelmann spruce
Mean site index:
Subalpine fir—91 (100-year site curve)
Western larch—49 (50-year site curve)
Estimated average annual production (CMAI):
Subalpine fir—93 cubic feet at 90 years of age
Western larch—61 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, mountain hemlock, Douglas-fir, western larch, Engelmann spruce, lodgepole pine, common beargrass, big blueberry, and rustyleaf menziesia
Management limitations:
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- Areas on ridges that are exposed to strong, persistent, cold winds are less productive than other areas.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use conventional methods when harvesting timber.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Common beargrass, rustyleaf menziesia, Piper's anemone, western rattlesnake plantain, darkwoods violet, sidebells shinleaf, common prince's pine, Utah honeysuckle, myrtle pachystima, and big blueberry
Total production of air-dry vegetation (pounds per

acre): 400

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 10 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,200 pounds of air-dry forage per acre to less than 400 pounds per acre as the canopy closes.

Management limitations:

- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.

Management practices:

- Manage trees and shrubs by clearing or thinning to create open areas for forage production.
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.

Building Site and Recreational Development

Management limitations:

- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:

- Design and construct roads, camp areas, and sanitary facilities to compensate for slope and large stones.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIe

61—Latour gravelly silt loam, 35 to 75 percent slopes

Composition

Latour and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-, east-, and west-facing mountain slopes; south-facing mountain slopes at high elevations
Slope range: 35 to 75 percent
Slope features: Concave to convex
Elevation: 4,800 to 6,200 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—grayish brown gravelly silt loam
2 to 18 inches—yellowish brown gravelly silt loam and light yellowish brown very gravelly silt loam
18 to 42 inches—light yellowish brown extremely cobbly silt loam
42 to 60 inches—light yellowish brown extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Talus and colluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:

- Joebaldy soils on south-facing slopes at higher elevations
- Ahrs soils on south-facing slopes at lower elevations
- Honeyjones soils on north-facing slopes at lower elevations
- Soils similar to Latour soils with bedrock at less than 60 inches on ridges and convex slopes
- Rubble land

Use and Management

Major current uses:

- Timber production
- Recreation
- Wildlife habitat
- Watershed

Potential uses:

- Livestock grazing

Woodland

Woodland suitability subclass: 7R
Trees suitable for planting: Subalpine fir and Engelmann spruce
Mean site index:
Subalpine fir—91 (100-year site curve)
Western larch—49 (50-year site curve)
Estimated average annual production (CMAI):
Subalpine fir—93 cubic feet at 90 years of age
Western larch—61 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, mountain hemlock, Douglas-fir, western larch, Engelmann spruce, lodgepole pine, common beargrass, big blueberry, and rustyleaf menziesia
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Common beargrass, rustyleaf menziesia, Piper's anemone, western rattlesnake plantain, darkwoods violet, sidebells shinleaf, common prince's pine, Utah honeysuckle, myrtle pachystima, and big blueberry
Total production of air-dry vegetation (pounds per acre): 400
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,200 pounds of air-dry forage per acre to less than 400 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIIe

62—Latour-Rubble land association, 35 to 75 percent slopes

Composition

Latour and similar soils: 45 percent
Rubble land: 30 percent
Contrasting inclusions: 25 percent

Latour

Setting

Landscape position: North-, east-, and west-facing mountain slopes; south-facing slopes at high elevations (fig. 14)
Slope range: 35 to 75 percent
Slope features: Concave to convex
Elevation: 4,800 to 6,200 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—grayish brown gravelly silt loam
2 to 18 inches—yellowish brown gravelly silt loam and light yellowish brown very gravelly silt loam
18 to 42 inches—light yellowish brown extremely cobbly silt loam
42 to 60 inches—light yellowish brown extremely cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Talus and colluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Rubble land

Setting

Landscape position: Mountainsides
- Rubble land consists of areas of stones and boulders that support little or no vegetation.
- Areas of rubble land are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Joebaldy soils on south-facing slopes at higher elevations
- Ahrs soils on south-facing slopes at lower elevations
- Honeyjones soils on north-facing slopes at lower elevations
- Soils with hard bedrock at 40 to 60 inches on convex slopes

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed
- Potential uses:
- Livestock grazing

Woodland

Latour

Woodland suitability subclass: 7R
Trees suitable for planting: Subalpine fir and Engelmann spruce
Mean site index:
Subalpine fir—91 (100-year site curve)
Western larch—49 (50-year site curve)
Estimated average annual production (CMAI):
Subalpine fir—93 cubic feet at 90 years of age
Western larch—61 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, mountain hemlock, Douglas-fir, western larch, Engelmann spruce, lodgepole pine, common beargrass, big blueberry, and rustyleaf menziesia
Management limitations:
- Areas of rubble land reduce yield about 30 percent.
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Areas of rubble land may cause breakage of timber and hinder yarding.

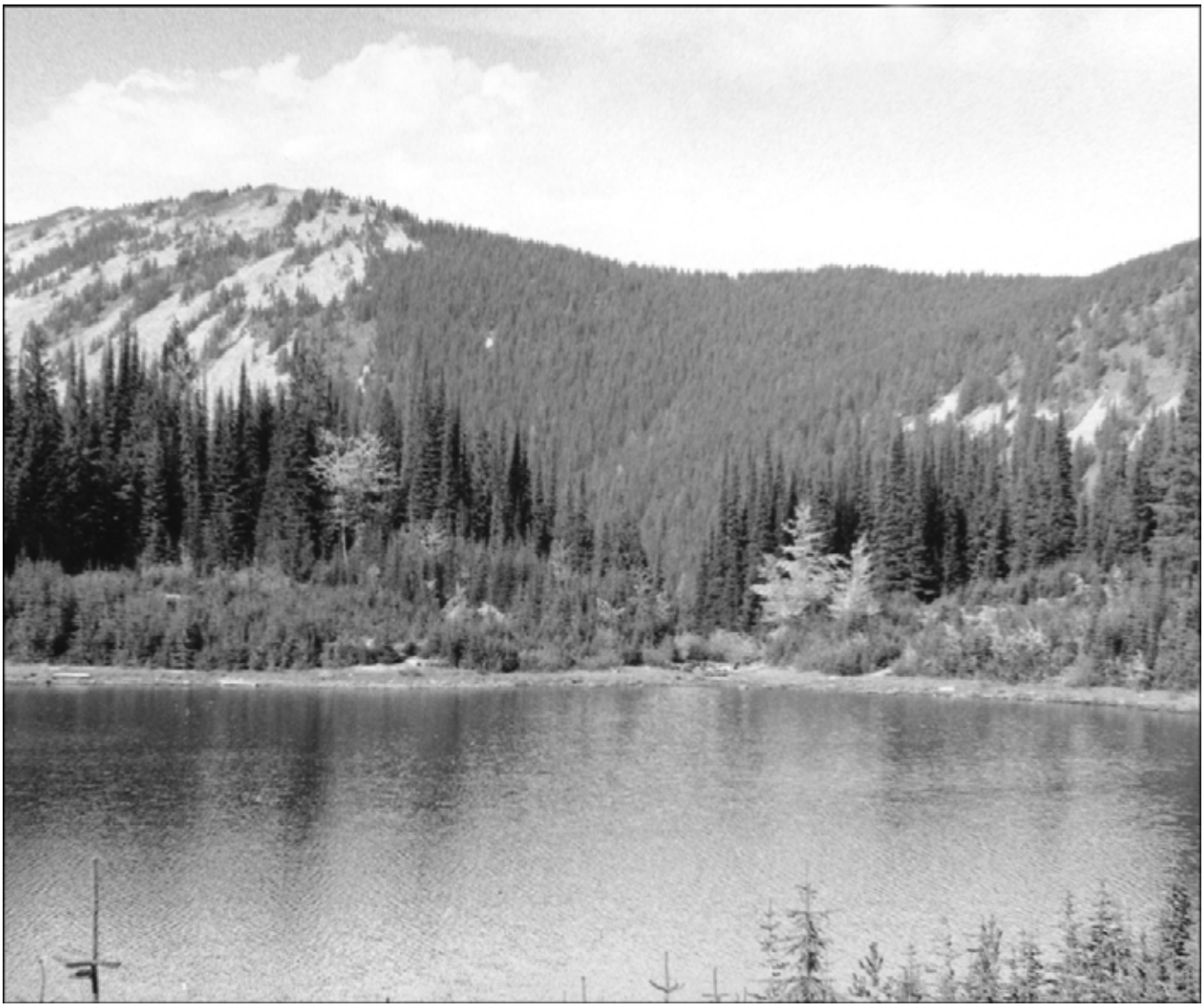


Figure 14.—An area of Latour-Rubble land association, 35 to 75 percent slopes, surrounding a high elevation alpine lake.

- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Common beargrass, rustyleaf menziesia, Piper's anemone, western rattlesnake plantain, darkwoods violet, sidebells shinleaf, common prince's pine, Utah honeysuckle, myrtle pachystima, and big blueberry

Total production of air-dry vegetation (pounds per acre): 400

Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 15 years after the canopy

is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,200 pounds of air-dry forage per acre to less than 400 pounds per acre as the canopy closes.

Management limitations:

- The production of forage is limited by the areas of rubble land, which generally interfere with the movement of livestock and limit the accessibility of forage.
- Slope may cause livestock distribution problems.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.

Building Site and Recreational Development

Management limitations:

- Slope and rubble land limit the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.

Management practices:

- Design and construct roads and trails to compensate for steepness of slope, large stones, and rubble land.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class:
Latour—VIIe
Rubble land—VIIIs

63—Lotuspoint-Rock outcrop complex, 35 to 75 percent slopes

Composition

Lotuspoint and similar soils: 55 percent
Rock outcrop: 25 percent
Contrasting inclusions: 20 percent

Lotuspoint

Setting

Landscape position: South-facing mountain slopes, breaklands, and canyonsides
Slope range: 35 to 75 percent
Slope features: Convex
Elevation: 2,160 to 4,000 feet
Mean annual precipitation: 28 to 35 inches
Mean annual air temperature: 47 to 49 degrees F
Frost-free period: 100 to 140 days

Typical Profile

Organic mat—0.75 inch thick
0 to 4 inches—dark grayish brown stony silt loam
4 to 9 inches—dark grayish brown very cobbly silt loam
9 to 30 inches—yellowish brown and light yellowish brown extremely cobbly silt loam
30 inches—hard, slightly fractured metasedimentary bedrock

Soil Properties and Qualities

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from metasedimentary bedrock with a mixture of volcanic ash and loess
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Moderate to severe

Rock outcrop

Setting

Landscape position: South-facing ridges, breaklands, and canyonsides

- Rock outcrop consists of areas of exposed metasedimentary bedrock.
- Areas of rock outcrop are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Ahrs soils on east- and west-facing mountain slopes
- Pinecreek soils on south-facing mountain slopes
- Tigley soils on south-facing foothills
- Soils that have bedrock at depths of 10 to 20 inches on ridges and knobs

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Lotuspoint

Woodland suitability subclass: 8R
Trees suitable for planting: Ponderosa pine
Mean site index:
Douglas-fir—66 (50-year site curve)
Ponderosa pine—109 (100-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—54 cubic feet at 106 years of age
Ponderosa pine—120 cubic feet at 40 years of age
Dominant vegetation in potential natural plant community: Douglas-fir, ponderosa pine, common snowberry, pine reedgrass, and mallow ninebark
Management limitations:
- Areas of rock outcrop reduce yield about 25 percent.
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- When building logging roads, the deep cuts needed to level the road surface can expose hard bedrock that is difficult to excavate.
- Areas of rock outcrop can interfere with logging and yarding operations and may cause breakage of timber.
- Reforestation is difficult on the hotter, drier, south-facing slopes because of droughtiness.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Roads built on 60 percent slopes or steeper must be full benched and erosion/sedimentation control practices, such as erosion mats and mulching on cut-and-fill slopes, should be used.
- Design and construct logging roads to compensate for limited depth to bedrock and areas of rock outcrop.
- Leave some of the larger trees to provide shade for seedlings.

Grazeable Understory

Common forest understory plants: Elk sedge, pine reedgrass, common snowberry, creambush oceanspray, mallow ninebark, Columbia brome, strawberry, heartleaf arnica, conspicuous aster, white spirea, baldhip rose, and low Oregongrape
Total production of air-dry vegetation (pounds per acre): 850
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 15 to 25 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 850 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.
- The production of forage is limited by the areas of rock outcrop, which generally interfere with the movement of livestock and limit the accessibility of forage.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Steepness of slope limits the use of this unit for building site and recreational development.

- Areas of rock outcrop in some areas may interfere with the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil, limited depth to bedrock, and areas of rock outcrop.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.

Management practices:

- Design and construct roads and trails to compensate for steepness of slope, limited depth to bedrock, large stones, and areas of rock outcrop.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class:
Lotuspoint—VIIe
Rock outcrop—VIIIs

64—Lotuspoint, very strongly acid-Rock outcrop complex, 35 to 75 percent slopes, eroded

Composition

Lotuspoint and similar soils: 55 percent
Rock outcrop: 30 percent
Contrasting inclusions: 15 percent

Lotuspoint

Setting

Landscape position: South-facing breaklands and canyonsides
Slope range: 35 to 75 percent
Slope features: Convex
Elevation: 2,300 to 3,400 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 47 to 49 degrees F
Frost-free period: 100 to 130 days

Typical Profile

0 to 5 inches—grayish brown and yellowish brown very cobbly silt loam, very strongly acid, high concentrations of heavy metals
5 to 20 inches—light yellowish brown and very pale brown very cobbly and extremely cobbly loam
20 to 28 inches—very pale brown extremely cobbly loam
28 inches—weathered metasedimentary bedrock

Soil Properties and Qualities

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock with a mixture of volcanic ash and loess
Permeability: Moderate
Available water capacity: Very low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Very rapid
Hazard of water erosion: Very severe
Acidity: Extremely acid or very strongly acid in the surface layer

Rock outcrop

Setting

Landscape position: Breaklands and canyonsides

- Rock outcrop consists of areas of exposed metasedimentary bedrock.
- Areas of rock outcrop are not suitable for most land uses.

Inclusions

Contrasting inclusions:

- Very strongly acid Pinecreek soils on east- and west-facing slopes
- Severely eroded soils similar to very strongly acid Lotuspoint soils on steeper south-facing convex slopes and ridges
- Rubble land

Use and Management

Major current uses:

- Recreation
- Wildlife habitat

Vegetation

Trees suitable for planting: Ponderosa pine and Austrian pine
Present vegetation: Small ponderosa pine, Rocky Mountain maple, willow, serviceberry, Columbia hawthorn, sheep sorrel dock, common snowberry, baldhip rose, blue elderberry, Lewis' mock orange, common chokecherry, Indianhemp dogbane, oatgrass, brackenfern, and redtop

- The presence of heavy metals and very high soil acidity have severely reduced natural plant succession and potential wood production. Normal habitat type is Douglas-fir/mallow ninebark.
- Approximately 55 percent of this unit is devoid of vegetation.

Management limitations:

- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.
- Livestock grazing is not feasible on this unit due to steepness of slope, lack of suitable forage vegetation, and concentration of heavy metals.
- Seeding and planting are limited by steep slopes, large stones, low available water capacity, water erosion, hot soil temperatures during summer, and areas of rock outcrop.

Management practices:

- Use plants and trees that tolerate high acidity and concentrations of heavy metals.
- Stabilize eroded areas before seeding and planting.
- The application of nitrogen fertilizer and other soil amendments is essential for plant establishment on this unit. Obtain a soil test for proper fertilizer management.
- Use plants that can tolerate hot summer temperatures and droughtiness.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Areas of rock outcrop in some areas may interfere with the use of construction equipment.
- Disturbing the soil increases the risk of erosion.
- Excavation is hampered by stones and cobbles in the soil.
- The deep cuts needed to level the road surface can expose soft bedrock; however, it can be easily excavated.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:

- Design and construct roads and trails to compensate for steepness of slope, large stones, limited depth to bedrock, and areas of rock outcrop.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Select plants adapted to high levels of soil acidity and high concentrations of heavy metals in establishing a plant cover.

Interpretive Groups

Capability class:
Lotuspoint—VIIe
Rock outcrop—VIIIs

65—Marblecreek-Rock outcrop complex, 35 to 75 percent slopes

Composition

Marblecreek and similar soils: 55 percent
Rock outcrop: 25 percent
Contrasting inclusions: 20 percent

Marblecreek

Setting

Landscape position: South-facing mountain slopes
Slope range: 35 to 75 percent
Slope features: Convex
Elevation: 2,600 to 4,800 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 110 days

Typical Profile

Organic mat—1.5-inches thick
0 to 3 inches—brown gravelly silt loam
3 to 11 inches—light yellowish brown gravelly silt loam
11 to 25 inches—very pale brown very gravelly sandy loam
25 to 44 inches—pink extremely gravelly sandy loam
44 to 60 inches—pink extremely cobbly loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Rock outcrop

Setting

Landscape position: South-facing mountain slopes and ridges
- Rock outcrop consists of areas of exposed quartzite and schist bedrock.
- Areas of rock outcrop are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Blackprince soils on south-facing slopes
- Soils similar to Marblecreek soils on south-facing slopes adjacent to areas of rock outcrop that have a very stony silt loam surface
- Lotuspoint soils on south-facing ridges
- Rubble land

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Marblecreek

Woodland suitability subclass: 10R
Trees suitable for planting: Grand fir and Douglas-fir
Mean site index:
Grand fir—97 (50-year site curve)
Douglas-fir—79 (50-year site curve)
Western larch—72 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—147 cubic feet at 91 years of age
Douglas-fir—79 cubic feet at 98 years of age
Western larch—105 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western larch, ponderosa pine, western white pine, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread
Management limitations:
- Areas of rock outcrop reduce yield about 25 percent.
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Areas of rock outcrop can interfere with logging and yarding operations and may cause breakage of timber.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.
- Road cutbanks are occasionally subject to caving.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Prepare the site carefully to control competing brushy vegetation.
- Stabilize road cutbanks to avoid the hazard of caving.

Grazeable Understory

Common forest understory plants: Starry false Solomon's seal, goldthread, myrtle pachystima, longtube twinflower, common snowberry, Columbia brome, American trailplant, Piper's anemone, Rocky Mountain maple, baldhip rose, Saskatoon serviceberry, white spirea, and queencup beadlily
Total production of air-dry vegetation (pounds per acre): 250
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:
- The production of forage is limited by the areas of rock outcrop, which generally interfere with the movement of livestock and limit the accessibility of forage.
- Slope may cause livestock distribution problems.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Areas of rock outcrop in some areas may interfere with the use of construction equipment.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road and trail hazards and increase maintenance costs.
- Road cutbanks are subject to caving.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope, rock outcrop, and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Excavations should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class:
Marblecreek soil—VIIe
Rock outcrop—VIIIs

66—Mazie silt loam, 0 to 2 percent slopes

Composition

Mazie and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Concave areas of flood plains
Slope range: 0 to 2 percent
Elevation: 2,800 to 3,000 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

0 to 11 inches—mottled dark gray and grayish brown silt loam
11 to 20 inches—mottled gray silt loam
20 to 38 inches—mottled pale yellow silty clay
38 to 60 inches—mottled reddish yellow and pale yellow loam and silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium derived from mixed sources
Permeability: Slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 0 to 18 inches—February to June; 18 to 60 inches—Rest of year
Hazard of flooding: Frequent: Long—February to May

Inclusions

Contrasting inclusions:
- Clarkia soils on higher positions on flood plains
- Ramsdell soils in wet depressions on low stream terraces
- Pokey soils on slightly higher positions along streambanks
- Bellslake soils in wet depressions of flood plains

Use and Management

Major current uses:
- Hayland
- Pastureland
- Wildlife habitat

Hayland and Pastureland

- Adapted improved forage plants are timothy, meadow foxtail, reed canarygrass, tall fescue, and alsike clover.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and lower forage production.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Providing drainage is difficult because most areas have poor outlets and are seasonally flooded.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Seed only forage plants that tolerate periodic inundation and seasonal wetness.
- Use open ditches or tile drains to remove water on or near the surface.
- Provide water control structures to reduce the risk of flooding.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding and wetness restrict building site and recreational development.
- Excavation cutbanks are subject to slumping.
- The quality of roadbeds and road surfaces can be adversely affected by frost action, shrinking and swelling, and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness, flooding, and the restricted permeability of the soil.

Management practices:
- Design and construct buildings and roads to compensate for seasonal flooding, wetness, frost action, and the limited ability of the soil to support a load.
- Stabilize embankments to prevent slumping when saturated.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Reduce wetness by providing suitably designed drainage ditches or tile drains.
- Design and construct septic tank absorption fields to compensate for seasonal wetness, flooding, and restricted soil permeability.

Interpretive Groups

Capability class: Vw

67—Meadowport silt loam, 15 to 35 percent slopes

Composition

Meadowport and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: North-, east-, and west-facing dissected terraces
Slope range: 15 to 35 percent
Slope features: Concave
Elevation: 3,800 to 4,000 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—1.5-inches thick
0 to 4 inches—pale brown silt loam
4 to 12 inches—light yellowish brown silt loam
12 to 25 inches—light yellowish brown and very pale brown silt loam
25 to 60 inches—light yellowish brown silty clay loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Glacial lake-laid sediments and old alluvium derived from granite and schist with a mantle of volcanic ash
Permeability: Slow
Available water capacity: Very high
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Severe
Depth to seasonal perched water table: 18 to 30 inches—February to April

Inclusions

Contrasting inclusions:
- Soils similar to Clarkia soils that have cooler soil temperatures along drainageways
- Odonnell soils on south-facing concave slopes
- Soils similar to Meadowport soils but with a cobbly substratum
- Floodwood soils on south-, east-, and west-facing convex slopes

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed
- Placer garnet mining

Woodland

Woodland suitability subclass: 8A
Trees suitable for planting: Subalpine fir and Engelmann spruce
Mean site index:
Engelmann spruce—100 (100-year site curve)
Estimated average annual production (CMAI):
Engelmann spruce—109 cubic feet at 90 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, Engelmann spruce,

western red cedar, arrowleaf groundsel, claspleaf twistedstalk, rustyleaf menziesia, and wild ginger

Management limitations:

- The seasonal perched water table restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.

Management practices:

- To reduce compaction and rutting, use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Stabilize road cutbanks to avoid slumping onto roadways.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Reduce dustiness in summer by surfacing logging roads adequately.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Rustyleaf menziesia, arrowleaf groundsel, claspleaf twistedstalk, queencup beadlily, threeparted miterwort, starry false Solomon's seal, wild ginger, dampwoods blueberry, Carolina bugbane, baneberry, bearberry, honeysuckle, and Columbia brome

Total production of air-dry vegetation (pounds per acre): 550

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,200 pounds of air-dry forage per acre to less than 550 pounds per acre as the canopy closes.

Management limitations:

- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.

Management practices:

- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:

- Seasonal wetness restricts building site and recreational development.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.

Management practices:

- Design and construct buildings and roads to compensate for slope, frost action, seasonal wetness, and the limited ability of the soil to support a load when wet.
- Design and construct septic tank absorption fields to compensate for the restricted soil permeability, seasonal wetness, and slope.
- Preserve the existing plant cover during construction to reduce the risk of erosion.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Stabilize disturbed areas to reduce the risk of

erosion and the maintenance costs resulting from erosion.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Construct roads with heavy base rock for year-round use.
- Reduce dustiness in summer by surfacing roads adequately.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIe

68—Miesen silt loam, 0 to 2 percent slopes

Composition

Miesen and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Natural levees, low stream terraces, and flood plains
Slope range: 0 to 2 percent
Slope features: Convex
Elevation: 2,130 to 2,240 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 26 inches—grayish brown silt loam
26 to 45 inches—grayish brown and mottled brown silt loam
45 to 60 inches—mottled pale brown silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Alluvium derived from mixed sources
Permeability: Moderate in the upper part and moderate to moderately rapid below
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 24 to 42 inches—February to June; 42 to more than 60 inches—Rest of year
Hazard of flooding: Occasional: Brief—February to May

Inclusions

Contrasting inclusions:
- Ramsdell soils in depressions on flood plains and low stream terraces
- Bellslake soils in lower depressions on flood plains
- Soils in very wet depressions on flood plains that are organic throughout
- Pokey soils on low stream terraces

Use and Management

Major current uses:
- Hayland
- Pastureland
- Recreation
- Wildlife habitat
- Homesites

Hayland and Pastureland

- Adapted improved forage plants are timothy, tall fescue, smooth brome, reed canarygrass, clover, and alfalfa.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and lower forage production.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Providing drainage is difficult because most areas have poor outlets and are seasonally flooded.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Seed only the hay and pasture plants that tolerate periodic inundation and seasonal wetness.
- Provide water control structures to reduce the risk of flooding.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding and wetness restrict building site and recreational development.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- Septic tank absorption fields can be expected to

function poorly because of seasonal wetness and flooding.
- Embankments are subject to piping and slumping when saturated.

Management practices:
- Design and construct buildings, camp areas, roads, and septic tank absorption fields to compensate for flooding and seasonal wetness.
- Design and construct buildings and roads to compensate for frost action.
- Reduce wetness by providing suitably designed drainage ditches or tile drains.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Susceptibility of the soil to slumping and piping when saturated requires special design of water retention structures.

Interpretive Groups

Capability class: IVw

69—Miesen-Ramsdell silt loams, 0 to 4 percent slopes

Composition

Miesen and similar soils: 45 percent
Ramsdell and similar soils: 40 percent
Contrasting inclusions: 15 percent

Miesen

Setting

Landscape position: Flood plains, natural levees, and low stream terraces
Slope range: 0 to 4 percent
Slope features: Concave to convex
Elevation: 2,130 to 2,200 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 26 inches—grayish brown silt loam
26 to 45 inches—grayish brown and mottled brown silt loam
45 to 60 inches—mottled pale brown silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Alluvium derived from mixed sources
Permeability: Moderate in the upper part and moderate to moderately rapid below
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 24 to 42 inches—February to June; 42 to more than 60 inches—Rest of year
Hazard of flooding: Occasional: Brief—February to May

Ramsdell

Setting

Landscape position: Depressions on flood plains and low stream terraces
Slope range: 0 to 2 percent
Elevation: 2,130 to 2,200 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 6 inches—mottled light brownish gray silt loam
6 to 36 inches—mottled light brownish gray and light gray silt loam
36 to 60 inches—mottled pale yellow silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Silty alluvium derived from mixed sources
Permeability: Moderate
Available water capacity: High
Potential rooting depth: More than 60 inches
Rate of surface runoff: Very slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 0 to 18 inches—February to June; 18 to 60 inches—Rest of year
Hazard of flooding: Frequent: Long—February to June

Inclusions

Contrasting inclusions:
- Bellslake soils on lower positions of flood plains
- Mazie soils on lower positions of stream terraces

- Soils in very wet depressions of flood plains that are organic throughout
- Pokey soils on low stream terraces

Use and Management

Major current uses:
- Hayland (fig. 15)
- Pastureland
- Recreation
- Wildlife habitat
- Homesites

Hayland and Pastureland

- Some of the adapted forage plants are meadow foxtail, tall fescue, timothy, reed canarygrass, alsike clover, and bird's-foot trefoil.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and lower forage production.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Providing drainage is difficult because most areas have poor outlets and are seasonally flooded.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Seed only forage plants that tolerate periodic inundation and seasonal wetness.
- Use open ditches or tile drains to remove water on or near the surface.
- Provide water control structures to reduce the risk of flooding.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding and wetness restrict building site and recreational development.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and flooding.
- Embankments are subject to piping and slumping when saturated.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.

Management practices:
- Design and construct buildings, roads, camp areas, and septic tank absorption fields to compensate for seasonal wetness and flooding.
- Reduce wetness by providing suitably designed drainage ditches or tile drains.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Stabilize embankments to prevent piping and slumping when saturated.
- Design and construct buildings and roads to compensate for frost action.

Interpretive Groups

Capability class:
Miesen—IVw
Ramsdell soil—Vw

70—Nakarna silt loam, 15 to 35 percent slopes

Composition

Nakarna and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing mountain slopes and ridges
Slope range: 15 to 35 percent
Slope features: Convex
Elevation: 2,800 to 4,800 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 42 to 43 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—pale brown silt loam
2 to 14 inches—light yellowish brown silt loam
14 to 34 inches—pale brown and very pale brown loam and fine sandy loam
34 to 47 inches—very pale brown cobbly fine sandy loam
47 inches—highly weathered soft micaceous schist bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from micaceous schist bedrock, with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below to soft bedrock
Available water capacity: Moderate

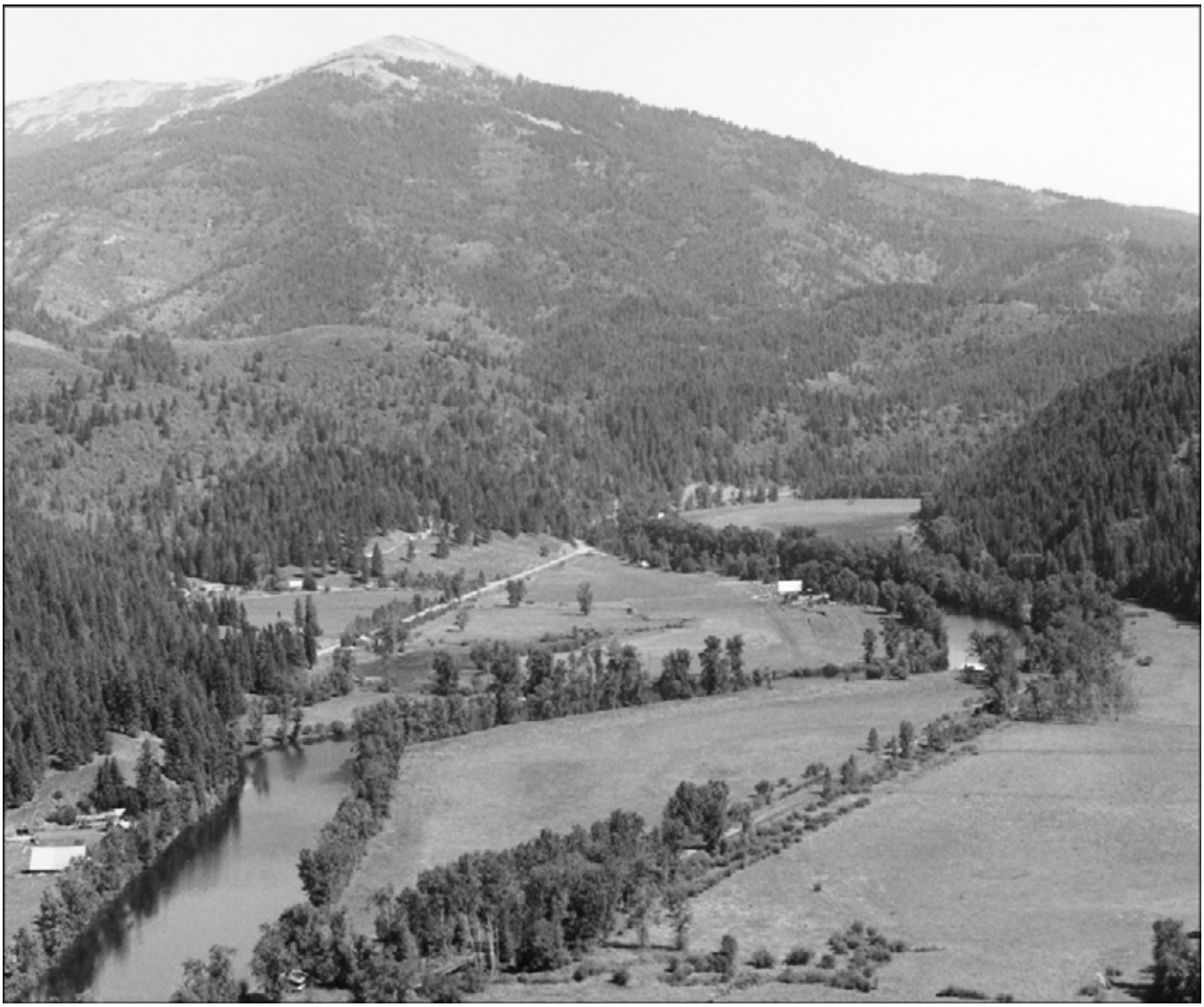


Figure 15.—An area of Miesen-Ramsdell silt loams, 0 to 4 percent slopes, used for hay and pasture along the St. Joe River. Ahrs and Pinecreek soils are on the mountains in the background.

Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium
Hazard of water erosion: Moderate in surface layers and severe in subsoil

Inclusions

Contrasting inclusions:
- Bouldercreek soils on north-facing canyon slopes near drainageways
- Flewsie soils on north-facing slopes of foothills
- Jacot soils on foothills
- Kruse soils on south-facing concave slopes
- Ahrs soils on east- and west-facing convex mountain slopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Woodland suitability subclass: 10A
Trees suitable for planting: Western white pine, grand fir, and Douglas-fir
Mean site index:
Western white pine—71 (50-year site curve)
Grand fir—91 (50-year site curve)

Estimated average annual production (CMAI):
Western white pine—137 cubic feet at 105 years of age
Grand fir—135 cubic feet at 95 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread
Management limitations:
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use conventional methods in harvesting timber.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Stabilize road cutbanks to avoid slumping onto roadways.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, queencup beadlily, longtube twinflower, oneleaf foamflower, big blueberry, goldthread, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, shinyleaf spirea, starry false Solomon's seal, and western rattlesnake plantain
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are very slippery when wet.
- Road cutbanks are subject to slumping.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.

Management practices:
- Design and construct buildings and roads to compensate for slope and frost action.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.

Interpretive Groups

Capability class: VIe

71—Nakarna silt loam, 35 to 65 percent slopes

Composition

Nakarna and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 2,800 to 4,800 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 42 to 43 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—pale brown silt loam
2 to 14 inches—light yellowish brown silt loam
14 to 34 inches—pale brown and very pale brown loam and fine sandy loam
34 to 47 inches—very pale brown cobbly fine sandy loam
47 inches—highly weathered soft micaceous schist bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from micaceous schist bedrock, with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below to soft bedrock
Available water capacity: Moderate
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and very severe in subsoil

Inclusions

Contrasting inclusions:
- Bouldercreek and Honeyjones soils on north-facing canyon slopes along drainageways
- Flewsie soils on north-facing slopes of foothills
- Kruse soils on south-facing concave slopes
- Ahrs soils on east- and west-facing slopes

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability group: 10R
Trees suitable for planting: Western white pine, grand fir, and Douglas-fir
Mean site index:
Western white pine—71 (50-year site curve)
Grand fir—91 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—137 cubic feet at 105 years of age
Grand fir—135 cubic feet at 95 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Road failure and landslides may occur after road construction and clearcutting.
- Road cutbanks are subject to slumping when saturated.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Because sliding and slumping can result if the soil is disturbed, use the kind of logging methods that disturb the soil least and stabilize cuts and fills.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, queencup beadlily, longtube twinflower, oneleaf foamflower, big blueberry, goldthread, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, shinyleaf spirea, starry false Solomon's seal, and western rattlesnake plantain
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are very slippery when wet.

- Excavation increases the risk of soil slippage.
- Road cutbanks are subject to slumping.

Management practices:

- Design and construct roads to compensate for the steepness of slope and the hazard of soil slippage.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Stabilize cutbanks to avoid slumping onto the roadway.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIIe

72—Nakarna silt loam, high precipitation, 15 to 35 percent slopes

Composition

Nakarna and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: East- and north-facing foothills, mountain slopes, and ridges
Slope range: 15 to 35 percent
Slope features: Concave to convex
Elevation: 3,500 to 4,700 feet
Mean annual precipitation: 45 to 50 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—pale brown silt loam
2 to 14 inches—light yellowish brown silt loam
14 to 34 inches—pale brown and very pale brown loam and fine sandy loam
34 to 47 inches—very pale brown cobbly fine sandy loam
47 inches—highly weathered soft micaceous schist bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from micaceous schist bedrock, with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below to soft bedrock
Available water capacity: Moderate
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium
Hazard of water erosion: Slight in surface layers and severe in subsoil

Inclusions

Contrasting inclusions:

- Bouldercreek, high precipitation soils on north-facing canyon slopes near drainageways
- Flewsie, high precipitation soils on convex slopes of foothills
- Marblecreek soils on south-facing mountain slopes near drainageways
- Odonnell soils on concave toeslopes
- Floodwood soils on convex slopes of foothills

Use and Management

Major current uses:

- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat

Woodland

Woodland suitability subclass: 9A
Trees suitable for planting: Douglas-fir, grand fir, and western white pine
Mean site index:
Douglas-fir—76 (50-year site curve)
Grand fir—87 (50-year site curve)
Western larch—70 (50-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—73 cubic feet at 99 years of age
Grand fir—127 cubic feet at 99 years of age
Western larch—101 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, wild ginger, longtube twinflower, Rocky Mountain maple, and goldthread
Management limitations:

- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.

- Logging roads are subject to rutting if used when wet.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use conventional methods in harvesting timber.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.

Grazeable Understory

Common forest understory plants: Columbia brome, wild ginger, baldhip rose, common prince's pine, queencup beadlily, longtube twinflower, dampwoods blueberry, darkwoods violet, Utah honeysuckle, Rocky Mountain maple, goldthread, starry false Solomon's seal, and western rattlesnake plantain

Total production of air-dry vegetation (pounds per acre): 100

Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management practices:
- If trees and shrubs are managed to create open areas, a good stand of plants suitable for use as forage can be produced.

Building Site and Recreational Development

Management limitations:
- Slope limits use of the steeper areas of this unit for site development.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are slippery and unstable when wet.
- Excavation cutbanks are subject to slumping.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.

Management practices:
- Design and construct buildings and roads to compensate for slope and frost action.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Stabilize cutbanks to avoid slumping onto the roadway.

Interpretive Groups

Capability class: VIe

73—Nakarna silt loam, high precipitation, 35 to 65 percent slopes

Composition

Nakarna and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: North-, east-, and west-facing foothills and mountain slopes
Slope range: 35 to 65 percent
Slope features: Convex
Elevation: 3,500 to 4,700 feet
Mean annual precipitation: 45 to 50 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—pale brown silt loam
2 to 14 inches—light yellowish brown silt loam
14 to 34 inches—pale brown and very pale brown loam and fine sandy loam
34 to 47 inches—very pale brown cobbly fine sandy loam
47 inches—highly weathered soft micaceous schist bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from micaceous schist bedrock, with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below to soft bedrock
Available water capacity: Moderate
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium to rapid

Hazard of water erosion: Moderate in surface layers and very severe in subsoil

Inclusions

Contrasting inclusions:
- Bouldercreek, high precipitation soils on north-facing canyon slopes near drainageways
- Flewsie, high precipitation soils on convex slopes of foothills
- Marblecreek soils on south-facing mountain slopes near drainageways

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 9R
Trees suitable for planting: Douglas-fir, grand fir, and western white pine
Mean site index:
Douglas-fir—76 (50-year site curve)
Grand fir—87 (50-year site curve)
Western larch—70 (50-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—73 cubic feet at 99 years of age
Grand fir—127 cubic feet at 99 years of age
Western larch—101 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, wild ginger, longtube twinflower, Rocky Mountain maple, and goldthread
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.
- Constructing roads at midslope results in large cuts and fills which increase the risk of slumping and erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.
- Logging roads require suitable surfacing and a stable base for use during wet periods.

Grazeable Understory

Common forest understory plants: Columbia brome, wild ginger, baldhip rose, common prince's pine, queencup beadlily, longtube twinflower, dampwoods blueberry, darkwoods violet, Utah honeysuckle, Rocky Mountain maple, goldthread, starry false Solomon's seal, and western rattlesnake plantain
Total production of air-dry vegetation (pounds per acre): 100
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Road cutbanks are subject to erosion and slumping.
- Unsurfaced access roads are subject to rilling and gullying and are slippery and unstable when wet.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Stabilize cutbanks to avoid slumping onto the roadway.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIIe

74—Nakarna complex, 35 to 65 percent slopes

Composition

Nakarna and similar soils: 45 percent
Nakarna, warm and similar soils: 35 percent
Contrasting inclusions: 20 percent

Nakarna

Setting

Landscape position: North-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Convex to plane
Elevation: 3,200 to 4,600 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 41 to 43 degrees F
Frost-free period: 70 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—pale brown silt loam
2 to 14 inches—light yellowish brown silt loam
14 to 34 inches—pale brown and very pale brown loam and fine sandy loam
34 to 47 inches—very pale brown cobbly fine sandy loam
47 inches—highly weathered soft micaceous schist bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from micaceous schist bedrock, with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below to soft bedrock
Available water capacity: Moderate
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and very severe in subsoil

Nakarna, warm

Setting

Landscape position: South-facing mountain slopes
Elevation: 3,200 to 4,600 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 100 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—pale brown silt loam
2 to 14 inches—light yellowish brown silt loam
14 to 34 inches—pale brown and very pale brown loam and fine sandy loam
34 to 47 inches—very pale brown cobbly fine sandy loam
47 inches—highly weathered soft micaceous schist bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from micaceous schist bedrock, with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below to soft bedrock
Available water capacity: Moderate
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and very severe in subsoil

Inclusions

Contrasting inclusions:
- Marblecreek soils on south-facing mountain slopes
- Keeler soils on south-facing foothills
- Bouldercreek soils on north facing mountain slopes
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Nakarna

Woodland suitability subclass: 10R

Trees suitable for planting: Western white pine, grand fir, and Douglas-fir
Mean site index:
Western white pine—71 (50-year site curve)
Grand fir—91 (50-year site curve)
Estimated average annual production (CMAI):
Western white pine—137 cubic feet at 105 years of age
Grand fir—135 cubic feet at 95 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, myrtle pachystima, longtube twinflower, and goldthread

Nakarna, warm

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir, Douglas-fir, and western white pine
Mean site index:
Grand fir—87 (50-year site curve)
Douglas-fir—76 (50-year site curve)
Western larch—70 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—127 cubic feet at 99 years of age
Douglas-fir—73 cubic feet at 99 years of age
Western larch—101 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, longtube twinflower, and goldthread
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Road failure and landslides may occur after road construction and clearcutting.
- Road cutbanks are subject to slumping when saturated.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Because sliding and slumping can result if the soil is disturbed, use the kind of logging methods that disturb the soil least and stabilize cuts and fills.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.

Grazeable Understory

Nakarna soil

Common forest understory plants: Myrtle pachystima, queencup beadlily, longtube twinflower, oneleaf foamflower, big blueberry, darkwoods violet, bunchberry dogwood, common prince's pine, common snowberry, shinyleaf spirea, goldthread, starry false Solomon's seal, and western rattlesnake plantain
Total production of air-dry vegetation (pounds per acre): 200

Nakarna, warm

Common forest understory plants: Columbia brome, oneleaf foamflower, queencup beadlily, goldthread, longtube twinflower, starry false Solomon's seal, common prince's pine, western rattlesnake plantain, darkwoods violet, common snowberry, baldhip rose, Utah honeysuckle, and dampwoods blueberry
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,500 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.

- Unsurfaced access roads are subject to rilling and gullying and are very slippery when wet.
- Excavation increases the risk of soil slippage.
- Road cutbanks are subject to slumping.

Management practices:

- Design and construct roads to compensate for steepness of slope and the hazard of soil slippage.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Stabilize cutbanks to avoid slumping onto the roadway.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIIe

75—Nakarna-Flewsie silt loams, high precipitation, 35 to 65 percent slopes

Composition

Nakarna and similar soils: 40 percent
Flewsie and similar soils: 35 percent
Contrasting inclusions: 25 percent

Nakarna

Setting

Landscape position: East- and west-facing mountain slopes and foothills
Slope range: 35 to 65 percent
Slope features: Convex to plane
Elevation: 3,500 to 4,700 feet
Mean annual precipitation: 45 to 50 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 90 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—pale brown silt loam
2 to 14 inches—light yellowish brown silt loam
14 to 34 inches—pale brown and very pale brown loam and fine sandy loam
34 to 47 inches—very pale brown cobbly fine sandy loam
47 inches—highly weathered soft micaceous schist bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from micaceous schist bedrock, with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderately rapid below to soft bedrock
Available water capacity: Moderate
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and very severe in subsoil

Flewsie

Setting

Landscape position: East- and west-facing slopes of foothills and mountains
Slope range: 35 to 65 percent
Slope features: Convex to plane, steep and very steep
Elevation: 3,500 to 4,700 feet
Mean annual precipitation: 45 to 50 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 90 days

Typical Profile

Organic mat—3-inches thick
0 to 4 inches—yellowish brown silt loam
4 to 15 inches—light yellowish brown silt loam
15 to 37 inches—pale brown and pale yellow fine sandy loam
37 to 60 inches—light gray loamy fine sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from fine-grained quartzite with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and rapid below
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate in surface layers and very severe in subsoil

Inclusions

Contrasting inclusions:
- Marblecreek soils on south-facing mountain slopes
- Bouldercreek, high precipitation soils on north-facing mountain slopes
- Nakarna, high precipitation soils on slopes less than 35 percent
- Flewsie, high precipitation soils on slopes less than 35 percent

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Nakarna

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir, Douglas-fir, and western white pine
Mean site index:
Douglas-fir—76 (50-year site curve)
Grand fir—87 (50-year site curve)
Western larch—70 (50-year site curve)
Estimated average annual production (CMAI):
Douglas-fir—73 cubic feet at 99 years of age
Grand fir—127 cubic feet at 99 years of age
Western larch—101 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, wild ginger, longtube twinflower, Rocky Mountain maple, and goldthread

Flewsie

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir, Douglas-fir, and western white pine
Mean site index:
Grand fir—88 (50-year site curve)
Douglas-fir—80 (50-year site curve)
Western larch—77 (50-year site curve)
Western white pine—76 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—129 cubic feet at 98 years of age
Douglas-fir—81 cubic feet at 97 years of age
Western larch—116 cubic feet at 70 years of age
Western white pine—146 cubic feet at 100 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, queencup beadlily, wild ginger, longtube twinflower, goldthread, and Rocky Mountain maple

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- When wet, unsurfaced roads and skid trails are slippery and unstable on the Nakarna soil. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.
- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion and slumping on the Nakarna soil.
- Road cutbanks are subject to caving and erosion on the Flewsie soil.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.

Management practices:
- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Logging roads require suitable surfacing and a stable base for use during wet periods on the Nakarna soil.
- Stabilize road cutbanks on the Flewsie soil to avoid the hazard of caving.
- Because sliding and slumping can result if the Nakarna soil is disturbed, use the kind of logging methods that disturb the soil least and stabilize cuts and fills.
- Roads and skid trails should be stabilized by seeding, mulching, erosion blankets, installing rolling dips or water bars, and in-sloping with cross drains. These are needed to prevent erosion and sediment delivery.

Grazeable Understory

Nakarna

Common forest understory plants: Columbia brome, queencup beadlily, longtube twinflower, dampwoods blueberry, darkwoods violet, Rocky Mountain maple, Utah honeysuckle, wild ginger, common prince's pine, baldhip rose, goldthread, starry false Solomon's seal, and western rattlesnake plantain
Total production of air-dry vegetation (pounds per acre): 100

Flewsie

Common forest understory plants: Wild ginger, queencup beadlily, goldthread, longtube twinflower, starry false Solomon's seal, common prince's pine, western rattlesnake plantain, darkwoods violet, myrtle pachystima, Rocky Mountain maple, and big blueberry
Total production of air-dry vegetation (pounds per acre): 100
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management limitations:
- Slope may cause livestock distribution problems.

Management practices:
- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying and are slippery and unstable on the Nakarna soil when wet.
- Cut slopes on the Nakarna soil are subject to slumping on to the roadway when the soil is saturated.
- Road cutbanks are subject to caving on the Flewsie soil.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet on the Nakarna soil.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Excavations should be designed to prevent road cutbanks from caving on the Flewsie soil.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.
- Because of the risk of seepage on the Flewsie soil, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

76—Odonnell silt loam, 15 to 35 percent slopes

Composition

Odonnell and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: Foothills
Slope range: 15 to 35 percent
Slope features: Concave
Elevation: 2,600 to 4,400 feet
Mean annual precipitation: 55 to 65 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—3-inches thick
0 to 4 inches—yellowish brown silt loam
4 to 14 inches—light yellowish brown silt loam
14 to 22 inches—mixed very pale brown and pink silt loam
22 to 50 inches—mixed yellow and reddish yellow silt loam and silty clay loam
50 to 60 inches—mixed yellow and reddish yellow silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Weathered material derived from anorthosite, schist, and gneiss bedrock with a thick mantle of volcanic ash
Permeability: Slow
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid

Hazard of water erosion: Severe
Depth to perched water table: 18 to 30 inches—February to April

Inclusions

Contrasting inclusions:
- Floodwood soils on convex slopes
- Helmer soils on concave toeslopes
- Hugus soils on steeper, north-facing convex slopes

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 11A
Trees suitable for planting: Western white pine and grand fir
Mean site index:
Grand fir—100 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—153 cubic feet at 89 years of age
Dominant vegetation in potential natural plant community: Western red cedar, western white pine, grand fir, Douglas-fir, western larch, common ladyfern, queencup beadlily, wild ginger, and oakfern
Management limitations:
- The seasonal perched water table restricts the use of equipment to periods when the soil is dry or frozen.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- Logging roads are subject to rutting if used when wet.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.

Management practices:
- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Stabilize road cutbanks to avoid slumping onto roadways.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Reduce dustiness in summer by surfacing logging roads adequately.

Grazeable Understory

Common forest understory plants: Common ladyfern, queencup beadlily, wild ginger, starry false Solomon's seal, American trailplant, sweetscented bedstraw, oneleaf foamflower, longtube twinflower, Piper's anemone, Oregon fairybells, and oakfern
Total production of air-dry vegetation (pounds per acre): 200
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,200 pounds of air-dry forage per acre to less than 200 pounds per acre as the canopy closes.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Seasonal wetness restricts site development.
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Unless an adequate wearing surface is maintained, dusty conditions in summer create road hazards and increase maintenance costs.
- Excavation increases the risk of water erosion and soil slippage.
- Unsurfaced access roads are subject to rilling and gullying and are slippery when wet.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.

- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.

Management practices:

- Design and construct buildings and roads to compensate for slope, seasonal wetness, low soil strength, and frost action.
- Design roads to control surface runoff and stabilize cut-and-fill slopes.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Reduce dustiness in summer by surfacing roads adequately.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Construct roads with heavy base rock for year-round use.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIe

77—Pinecreek gravelly silt loam, 35 to 65 percent slopes

Composition

Pinecreek and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: South-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Plane to convex
Elevation: 2,200 to 4,000 feet
Mean annual precipitation: 28 to 35 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

Organic mat—1-inch thick
0 to 10 inches—grayish brown and brown gravelly silt loam
10 to 22 inches—yellowish brown gravelly silt loam
22 to 37 inches—light yellowish brown very gravelly silt loam
37 to 60 inches—light yellowish brown extremely cobbly silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:

- Lotuspoint soils on south-facing convex slopes
- Ahrs soils on east- and west-facing slopes
- Tigley soils on east- and west-facing slopes at lower elevations
- Soils on south-facing convex slopes and ridges that have hard bedrock at depths of less than 20 inches
- Areas of rock outcrop

Use and Management

Major current uses:

- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 7R
Trees suitable for planting: Ponderosa pine and Douglas-fir
Mean site index:
Douglas-fir—72 (50-year site curve)
Estimated average annual production (CMAI):
Ponderosa pine—106 cubic feet at 40 years of age
Douglas-fir—65 cubic feet at 102 years of age

Dominant vegetation in potential natural plant community: Douglas-fir, ponderosa pine, mallow ninebark, common snowberry, creambush oceanspray, and pine reedgrass

Management limitations:

- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Reforestation is difficult on the hotter, drier, south-facing slopes because of droughtiness.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:

- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Leave some of the larger trees to provide shade for seedlings.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Elk sedge, pine reedgrass, Columbia brome, strawberry, heartleaf arnica, conspicuous aster, white spirea, mallow ninebark, creambush oceanspray, common snowberry, baldhip rose, and low Oregongrape

Total production of air-dry vegetation (pounds per acre): 850

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 15 to 25 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,800 pounds of air-dry forage per acre to less than 850 pounds per acre as the canopy closes.

Management limitations:

- Slope may cause livestock distribution problems.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:

- Design and construct roads to compensate for the steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.

Interpretive Groups

Capability class: VIIe

78—Pinecreek-Lotuspoint complex, strongly acid, 35 to 65 percent slopes, eroded

Composition

Pinecreek and similar soils: 55 percent
Lotuspoint and similar soils: 30 percent
Contrasting inclusions: 15 percent

Pinecreek

Setting

Landscape position: Southeast- and southwest-facing mountain slopes
Slope range: 35 to 65 percent
Slope features: Plane to convex
Elevation: 2,250 to 3,600 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

Organic mat—0.5-inch thick
0 to 5 inches—grayish brown gravelly silt loam, strongly acid, high concentrations of heavy metals
5 to 15 inches—brown gravelly silt loam
15 to 44 inches—light yellowish brown and very pale brown very gravelly silt loam and very gravelly loam
44 to 60 inches—very pale brown extremely gravelly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from metasedimentary bedrock with a thick mantle of volcanic ash
Permeability: Moderate
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid
Hazard of water erosion: Severe
Acidity: Very strongly acid or strongly acid in the surface layer

Lotuspoint

Setting

Landscape position: South-facing mountain slopes and ridges
Elevation: 2,300 to 3,600 feet
Slope range: 35 to 65 percent
Slope features: Convex
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 47 to 49 degrees F
Frost-free period: 100 to 130 days

Typical Profile

0 to 5 inches—grayish brown stony silt loam, very strongly acid, high concentrations of heavy metals
5 to 10 inches—yellowish brown very cobbly silt loam
10 to 22 inches—very pale brown very cobbly loam
22 to 34 inches—very pale brown extremely cobbly loam
34 inches—weathered metasedimentary bedrock

Soil Properties and Qualities

Depth class: Moderately deep (20 to 40 inches)
Drainage class: Well drained
Rock fragments on surface: 0.01 to 0.1 percent
Parent material: Weathered material derived from metasedimentary bedrock with a mixture of volcanic ash and loess
Permeability: Moderate
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Very rapid
Hazard of water erosion: Very severe
Acidity: Very strongly acid or strongly acid in the surface layer

Inclusions

Contrasting inclusions:
- Moderately acid Ahrs soils on east- and west-facing slopes
- Very strongly acid Tigley soils on southeast- and southwest-facing concave slopes
- Soils with bedrock at 40 to 60 inches similar to strongly acid Pinecreek soils on southeast- and southwest-facing convex slopes
- Areas of rock outcrop

Use and Management

Major current uses:
- Recreation
- Wildlife habitat

Woodland

Woodland suitability subclass: 4R
Trees suitable for planting: Ponderosa pine
Mean site index (estimated):
Ponderosa pine—75 (100-year site curve)
Estimated average annual production (CMAI):
Ponderosa pine—62 cubic feet at 45 years of age
Dominant vegetation in potential natural plant community: Douglas-fir, ponderosa pine, Rocky Mountain maple, Lewis' mock orange, willow, Columbia hawthorn, lupine, creambush oceanspray, snowbrush ceanothus, serviceberry, hairy brackenfern, common snowberry, common chokecherry, Indianhemp dogbane, oatgrass, and redtop
- The presence of heavy metals and very high soil acidity have severely reduced natural plant succession and potential wood production. Normal habitat type is Douglas-fir/mallow ninebark.
- Approximately 20 percent of this unit is devoid of vegetation.

Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the Lotuspoint soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated

soil material can also be a potential source of sedimentation.
- The deep cuts needed to level the road surface can expose soft bedrock on the Lotuspoint soil; however, it can be easily excavated.
- Reforestation is difficult on the hotter, drier, south-facing slopes because of droughtiness.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.

Management practices:
- Use high-lead or other cable logging that fully or partially suspend logs because it is less damaging to the soil.
- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Avoid excessive damage to the Lotuspoint soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites.
- These sites should be seeded.
- Prepare the site carefully to control competing brushy vegetation.
- Leave some of the larger trees to provide shade for seedlings.
- Use plants and trees that tolerate high acidity and concentrations of heavy metals and also hot summer temperatures and droughtiness.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of construction equipment.
- Disturbing the soil increases the risk of erosion.
- Plant cover may be affected by the acidity and concentrations of heavy metals.
- Excavation is hampered on the Lotuspoint soil by the stones and cobbles in the soil.
- The deep cuts needed to level the road surface can expose soft bedrock on the Lotuspoint soil; however, it can be easily excavated.
- Unless an adequate wearing surface is maintained, stones and cobbles in the Lotuspoint soil may create road and trail hazards and increase maintenance costs.

Management practices:
- Design and construct roads and trails to compensate for the steepness of slope.
- Design and construct roads and trails on the Lotuspoint soil to compensate for large stones and limited depth to bedrock.
- Avoid excessive damage to the Lotuspoint soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Select plants adapted to high levels of soil acidity and high concentrations of heavy metals in establishing a plant cover.

Interpretive Groups

Capability class: VIIe

79—Pokey-Typic Fluvaquents complex, 0 to 4 percent slopes

Composition

Pokey and similar soils: 50 percent
Typic Fluvaquents: 35 percent
Contrasting inclusions: 15 percent

Pokey

Setting

Landscape position: Flood plains and low stream terraces
Slope range: 0 to 4 percent
Slope features: Plane to convex
Elevation: 2,200 to 3,100 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

0 to 15 inches—grayish brown loam
15 to 27 inches—pale brown and mottled light gray loam and very fine sandy loam
27 to 60 inches—mottled light brownish gray and light gray loamy sand and coarse sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Alluvium derived from mixed sources
Permeability: Moderate in the upper part and rapid to very rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Slow
Hazard of water erosion: Slight

Depth to seasonal high water table: 18 to 30 inches—February through June; 30 to more than 60 inches—Rest of year
Hazard of flooding: Occasional: Brief—February to May

Typic Fluvaquents

Setting

Landscape position: Depressions and channels of flood plains and low stream terraces
Slope range: 0 to 2 percent
Slope features: Concave
Elevation: 2,200 to 3,100 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

0 to 3 inches—mottled light brownish gray fine sandy loam
3 to 37 inches—mottled light brownish gray, light olive gray, and gray stratified silt loam to loamy coarse sand
37 to 60 inches—gray stratified gravelly coarse sand to extremely gravelly coarse sand

Soil Properties and Qualities

Depth class: Moderately deep to sand, gravel, and cobbles
Drainage class: Very poorly drained
Parent material: Mixed alluvium derived from granite, schist, and quartzite
Permeability: Moderate to rapid in the upper part and very rapid below
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Very slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 0 to 18 inches—February through June; 18 to more than 60 inches—Rest of year
Hazard of flooding: Frequent: Long—February to May

Inclusions

Contrasting inclusions:
- Aquic Udifluvents on higher positions of flood plains
- Mazie soils on lower positions of flood plains
- Clarkia soils on higher positions of flood plains and low stream terraces
- Udarents, frequently flooded on areas of reclaimed stream dredgings

Use and Management

Major current uses:
- Hayland
- Pastureland
- Recreation
- Wildlife habitat

Hayland and Pastureland

- Adapted improved forage plants are timothy, orchardgrass, reed canarygrass, tall fescue, and clover.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and lower forage production.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Providing drainage is difficult because most areas have poor outlets and are seasonally flooded.

Management practices:
- Seed only forage plants that tolerate periodic inundation and seasonal wetness.
- Use open ditches or tile drains to remove water on or near the surface.
- Provide water control structures to reduce the risk of flooding.
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding and wetness restrict building site and recreational development.
- Cutbanks can cave because of the sandy substratum.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and flooding.
- The risk of seepage and the hazard of polluting the water supply limit the use of this unit as a septic tank absorption field.

Management practices:
- Design and construct roads and buildings to compensate for flooding, seasonal wetness, and frost action.
- Reduce wetness by providing suitably designed drainage ditches or tile drains.

- Design and construct septic tank absorption fields to compensate for wetness, flooding, and the hazard of seepage.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Excavations should be designed to prevent cutbanks from caving.

Interpretive Groups

Capability class:
Pokey—IVw
Typic Fluvaquents—Vw

80—Ramsdell silt loam, 0 to 2 percent slopes

Composition

Ramsdell and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Flood plains
Slope range: 0 to 2 percent
Elevation: 2,130 to 2,200 feet
Mean annual precipitation: 28 to 32 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 6 inches—mottled light brownish gray silt loam
6 to 36 inches—mottled light brownish gray and light gray silt loam
36 to 60 inches—mottled pale yellow silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Silty alluvium derived from mixed sources
Permeability: Moderate
Available water capacity: High
Potential rooting depth: 60 inches or more
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 0 to 18 inches—February to June; 18 to 60 inches—Rest of year
Hazard of flooding: Frequent: Long—February to June

Inclusions

Contrasting inclusions:
- Miesen soils on higher convex areas and natural levees
- Bellslake soils on lower positions on flood plains
- Mazie soils on lower positions on low stream terraces
- Soils in wet depressions on flood plains that are organic throughout

Use and Management

Major current uses:
- Hayland
- Pastureland
- Recreation
- Wildlife habitat

Hayland and Pastureland

- Adapted improved forage plants are timothy, meadow foxtail, reed canarygrass, tall fescue, alsike clover.

Management limitations:
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and lower forage production.
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Providing drainage is difficult because most areas have poor outlets and are seasonally flooded.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Seed only forage plants that tolerate periodic inundation and seasonal wetness.
- Use open ditches or tile drains to remove water on or near the surface.
- Provide water control structures to reduce the risk of flooding.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding and wetness restrict building site and recreational development.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and wetness.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and flooding.

- Embankments are subject to piping and slumping when saturated.

Management practices:
- Design and construct roads to compensate for seasonal wetness, flooding, and frost action.
- Reduce wetness by providing suitably designed drainage ditches or tile drains.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Construct roads with heavy base rock for year-round use.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Susceptibility of the soil to slumping and piping when saturated requires special design of water retention structures.

Interpretive Groups

Capability class: Vw

81—Redraven cobbly silt loam, 15 to 35 percent slopes

Composition

Redraven and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Glacial troughs
Slope range: 15 to 35 percent
Slope features: Concave to convex
Elevation: 4,200 to 4,800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 40 to 42 degrees F
Frost free period: 30 to 60 days

Typical Profile

Organic mat—2-inches thick
0 to 4 inches—pale brown cobbly silt loam
4 to 16 inches—light yellowish brown cobbly silt loam
16 to 35 inches—very pale brown very cobbly silt loam
35 to 50 inches—very pale brown extremely cobbly sandy loam
50 to 60 inches—very pale brown extremely bouldery sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage Class: Well drained
Parent material: Glacial till derived from gneiss, schist or quartzite rocks with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderate to moderately rapid below
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight

Inclusions

Contrasting inclusions:
- Soils similar to Redraven soils on south slopes at lower elevations that are warmer and have western hemlock as the dominant vegetation
- Bouldercreek soils on steeper slopes at lower elevations
- Vaywood soils on upper positions of slopes at higher elevations
- Aquic Udifluvents soils in drainageways

Use and Management

Current uses:
- Timber production
- Wildlife habitat
- Recreation
- Watershed

Potential uses:
- Livestock grazing

Woodland

Woodland suitability group: 7F
Trees suitable for planting: Subalpine fir and Engelmann spruce
Mean site index:
Subalpine fir—94 (100-year site curve)
Estimated average annual production (CMAI):
Subalpine fir—99 cubic feet at 90 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, mountain hemlock, Engelmann spruce, common beargrass, big blueberry, rustyleaf menziesia, and queencup beadlily

Management limitations:
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use conventional methods in harvesting timber.
- Avoid excessive disturbance on the soil to prevent more rock fragments from covering the surface.

- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Common beargrass, big blueberry, myrtle pachystima, elk sedge, Utah honeysuckle, Scouler's willow, western thimbleberry, queencup beadlily, rustyleaf menziesia, and Sitka mountain ash
Total production of air-dry vegetation (pounds per acre): 300
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,200 pounds of air-dry forage per acre to less than 300 pounds per acre as the canopy closes.

Management limitations:
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.

Management practices:
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- The hazard of seepage may cause contamination of nearby streams from sanitary facilities.

Management practices:
- Design and construct buildings, roads, camp areas, and trails to compensate for slope and large stones.
- Design and construct buildings and roads to compensate for frost action.
- Design and construct sanitary facilities to compensate for the hazard of seepage.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIe

82—Redraven bouldery silt loam, 15 to 35 percent slopes

Composition

Redraven and similar soils: 80 percent
Contrasting inclusions: 20 percent

Setting

Landscape position: Glacial troughs
Slope range: 15 to 35 percent
Slope features: Concave to plane
Elevation: 4,800 to 6,000 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—2-inches thick
0 to 2 inches—brown bouldery silt loam
2 to 17 inches—pale brown and light yellowish brown bouldery silt loam
17 to 29 inches—light yellowish brown very bouldery loam
29 to 44 inches—pale yellow extremely bouldery sandy loam
44 to 60 inches—pale yellow extremely bouldery loamy sand

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Rock fragments on surface (boulders): 0.01 to 0.1 percent
Parent material: Glacial till derived from gneiss, schist, or quartzite rocks with a thick mantle of volcanic ash
Permeability: Moderate to moderately rapid in the upper part and rapid below
Available water capacity: Low
Potential rooting depth: 60 inches or more

Rate of surface runoff: Medium
Hazard of water erosion: Slight

Inclusions

Contrasting inclusions:
- Vaywood soils on ridges and convex slopes
- Bouldercreek soils on steeper slopes at lower elevations
- Rubble land

Use and Management

Major current uses:
- Timber production
- Recreation
- Wildlife habitat
- Watershed

Potential uses:
- Livestock grazing

Woodland

Woodland suitability subclass: 7F
Trees suitable for planting: Subalpine fir and Engelmann spruce
Mean site index:
Subalpine fir—94 (100-year site curve)
Estimated average annual production (CMAI):
Subalpine fir—99 cubic feet at 90 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, Engelmann spruce, mountain hemlock, common beargrass, big blueberry, rustyleaf menziesia, and queencup beadlily
Management limitations:
- Boulders on the surface may cause breakage of timber and hinder yarding operations.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- Road cutbanks are occasionally subject to caving.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:
- Use conventional methods in harvesting timber.
- Stabilize road cutbanks to avoid the hazard of caving.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Common beargrass, myrtle pachystima, big blueberry, Piper's anemone, western rattlesnake plantain, darkwoods violet, sidebells shinleaf, common prince's pine, Utah honeysuckle, queencup beadlily, and rustyleaf menziesia
Total production of air-dry vegetation (pounds per acre): 400
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,200 pounds of air-dry forage per acre to less than 400 pounds per acre as the canopy closes.

Management limitations:
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.

Management practices:
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.

Building Site and Recreational Development

Management limitations:
- Slope limits the use of the steeper areas of this unit for site development.
- Slope in some areas may limit the use of construction equipment.
- Excavation is hampered by stones and boulders in the soil.
- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- Unless an adequate wearing surface is maintained, stones and boulders in the soil may create road and trail hazards and increase maintenance costs.
- Stones and boulders on the surface make the construction of roads and trails difficult.
- Cutbanks can cave because of the sandy substratum.
- The hazard of seepage may cause contamination of nearby streams from sanitary facilities.

Management practices:
- Design and construct buildings, camp areas, roads, and trails to compensate for slope and large stones.
- Excavations should be designed to prevent cutbanks from caving.
- Design and construct sanitary facilities to compensate for the hazard of seepage.
- Design and construct buildings and roads to compensate for frost action.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIe

83—Reggear silt loam, 3 to 20 percent slopes

Composition

Reggear and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Terraces
Slope range: 3 to 20 percent
Slope features: Concave to convex
Elevation: 2,500 to 3,400 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 11 inches—grayish brown, brown, and yellowish brown silt loam
11 to 18 inches—light yellowish brown silt loam
18 to 24 inches—mixed light yellowish brown and very pale brown silt loam
24 to 60 inches—mixed light brown and very pale brown, dense silty clay loam

Soil Properties and Qualities

Depth class: Moderately deep to a fragipan
Drainage class: Moderately well drained
Parent material: Loess deposits with minor amounts of volcanic ash
Permeability: Very slow
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate to severe
Depth to perched water table: 18 to 36 inches—February to April

Inclusions

Contrasting inclusions:
- Helmer and Sly soils on north-facing terrace slopes
- Clarkia soils on poorly drained positions near stream drainageways
- Agatha and Bobbitt soils on convex terrace escarpments

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Hayland
- Pastureland
- Homesites
- Recreation
- Wildlife habitat

Hayland and Pastureland

- Adapted improved forage plants are timothy, tall fescue, orchardgrass, smooth brome, clover.

Management limitations:
- Wetness limits the choice of plants, and limits the period of cutting or grazing.
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.
- These soils are susceptible to erosion by overgrazing on the steeper slopes.

Management practices:
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Seed only forage plants that tolerate seasonal wetness.
- Proper grazing use will ensure adequate vegetation to prevent erosion on steeper slopes.

Woodland

Woodland suitability subclass: 6D
Trees suitable for planting: Douglas-fir and ponderosa pine
Mean site index:
Grand fir—68 (50-year site curve)
Douglas-fir—69 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—91 cubic feet at 114 years of age
Douglas-fir—59 cubic feet at 104 years
Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, western white

pine, ponderosa pine, western larch, lodgepole pine, queencup beadlily, myrtle pachystima, and longtube twinflower

Management limitations:

- The seasonal perched water table restricts the use of equipment to periods when the soil is dry or frozen.
- Using wheeled and tracked equipment on wet soil produces ruts, compacts the soil, and damages tree roots.
- When wet, unsurfaced roads and skid trails are slippery and unstable. They may be impassable during rainy periods.
- Logging roads are subject to rutting if used when wet.
- Road cutbanks are subject to slumping when saturated.
- Logging roads, steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying.
- During periods of heavy rainfall and snowmelt, the perched water table is high for a period of time. Trees commonly are subject to windthrow because the soil is saturated during these periods, and roots are limited by the cemented and compacted layer in the soil.

Management practices:

- Use harvesting equipment only during dry periods because the soil is unsuited to traffic when wet.
- To reduce compaction and rutting, use suitable methods of harvest, lay out skid trails in advance, and harvest when the soil is dry or frozen.
- Logging roads require suitable surfacing and a stable base for use during wet periods.
- Reduce the risk of erosion by avoiding excessive disturbance on the soil.
- Roads and skid trails should be stabilized by installing rolling dips or water bars, seeding, slash windrows, erosion blankets, or mulching. These are needed to prevent erosion and sediment delivery.
- Stabilize road cutbanks to avoid slumping onto roadways.

Grazeable Understory

Common forest understory plants: Myrtle pachystima, queencup beadlily, baldhip rose, common snowberry, longtube twinflower, American trailplant, Piper's anemone, starry false Solomon's seal, Rocky Mountain maple, Saskatoon serviceberry, goldthread, Columbia brome, and white spirea

Total production of air-dry vegetation (pounds per acre): 250

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 1,600 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Management limitations:

- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, excessive runoff, and lower forage production.
- These soils are susceptible to erosion by overgrazing on the steeper slopes.

Management practices:

- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.
- Proper grazing use will ensure adequate vegetation to prevent erosion on steeper slopes.

Building Site and Recreational Development

Management limitations:

- Seasonal wetness restricts building site and recreational development.
- Excavation increases the risk of water erosion.
- Unsurfaced access roads are subject to rilling and gullying.
- Road cutbanks are subject to slumping and erosion.
- The quality of roadbeds and road surfaces can be adversely affected by frost action and low soil strength.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and the restricted permeability of the soil.
- Slope limits the use of the steeper areas of this unit for site development.

Management practices:

- Design and construct buildings and roads to compensate for seasonal wetness, low soil strength, frost action, and slope in steeper areas.
- Construct roads with heavy base rock for year-round use.
- Provide a stable base and an adequate wearing surface on roads to improve trafficability when wet.
- Because the soil is subject to slumping, especially in the steeper areas, locate roads in the more gently sloping areas and design road drainage systems to minimize the risk of slumping.
- Preserve the existing plant cover during construction to reduce the risk of erosion.
- Design roads and trails to control surface runoff and stabilize cut-and-fill slopes.

- Road surfaces should be graveled, and cut-and-fill slopes should be stabilized by seeding, mulching, or erosion mats. The subsoil is very erodible.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Design and construct septic tank absorption fields to compensate for seasonal wetness, restricted soil permeability, and slope in steeper areas.

Interpretive Groups

Capability class: IVe

84—Rock outcrop-Rubble land complex

Composition

Rock outcrop: 55 percent
Rubble land: 40 percent
Contrasting inclusions: 5 percent

Setting

Landscape position: Mountains, breaklands, and ridges
- Rock outcrop consists of areas of exposed bedrock. It is fractured in places, and some soil material is in the crevices.
- Rubble land consists of areas of stones and boulders that support little vegetation except for lichens and a few stunted shrubs or trees growing between the rock fragments.
- Areas of this unit are not suitable for most land uses.

Interpretive Groups

Capability class: VIIIs

85—Slickens

Composition

Slickens: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: Flood plains and low stream terraces
Slope range: 0 to 4 percent
Slope features: Concave to convex
Elevation: 2,250 to 2,400 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 100 to 130 days
- Slickens consists of areas of accumulations of coarse- to medium-textured ground rock that has commonly undergone chemical treatment during the ore-milling process. Slickens not confined to specially constructed basins may be mixed with alluvium.

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained and somewhat poorly drained
Permeability: Moderate to very rapid
Rate of surface runoff: Slow
Hazard of water erosion: Severe (channelization during occasional flooding)
Hazard of water erosion: Very severe
Depth to seasonal high water table: 18 to 54 inches—February through May; 54 to more than 60 inches—Rest of year
Hazard of flooding: Occasional: Brief—January through May
- Areas of slickens are detrimental to plant growth because of the high concentrations of heavy metals and are not suitable for most land uses.

Inclusions

Contrasting inclusions:
- Udarents on stream terraces
- Aquic Udifluvents, disturbed on low stream terraces adjacent to drainageways
- Dumps and mine tailings

Interpretive Groups

Capability class: VIIIs

86—Tigley gravelly loam, very strongly acid, 30 to 60 percent slopes, eroded

Composition

Tigley and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: South-facing foothills and dissected terrace escarpments
Slope range: 30 to 60 percent
Slope features: Plane to convex
Elevation: 2,250 to 3,400 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 6 inches—brown and yellowish brown gravelly loam, very strongly acid, high concentrations of heavy metals
6 to 15 inches—very pale brown very gravelly loam
15 to 54 inches—very pale brown and light yellowish brown extremely gravelly silty clay loam and extremely gravelly loam
54 to 60 inches—very pale brown extremely gravelly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Very rapid
Hazard of water erosion: Very severe
Acidity: Very strongly acid or strongly acid in the surface layer

Inclusions

Contrasting inclusions:
- Severely eroded soils similar to very strongly acid Tigley soils on steeper convex slopes
- Strongly acid Pinecreek soils on southeast- and southwest-facing slopes at higher elevations
- Strongly acid Lotuspoint soils on south-facing convex slopes and canyon breaks
- Strongly acid Hobo soils on less sloping hilltops
- Areas of rock outcrop

Use and Management

Major current uses:
- Recreation
- Wildlife habitat

Vegetation

Trees suitable for planting: Western white pine, Douglas-fir, and ponderosa pine
Present vegetation: Small western white pine and ponderosa pine, quaking aspen, willow, Lewis' mock orange, serviceberry, black hawthorn, brackenfern, Indianhemp dogbane, oatgrass, redtop, sheep sorrel dock, common snowberry, redstem ceanothus, low Oregongrape, and Rocky Mountain maple
- The presence of heavy metals and very high soil acidity have severely reduced natural plant succession and potential wood production. Normal habitat type is grand fir/mallow ninebark.
- Approximately 30 percent of this unit is devoid of vegetation.

Management limitations:
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.
- Livestock grazing is not feasible on this unit due to steepness of slope, lack of suitable forage vegetation, and concentration of heavy metals.
- Seeding and planting are limited by steep slopes, low available water capacity, water erosion, and hot soil temperatures during summer.

Management practices:
- Stabilize eroded areas before seeding and planting.
- Use plants and trees that can tolerate high concentrations of heavy metals, high levels of soil acidity, and hot summer temperatures.
- The application of nitrogen fertilizer and other soil amendments is essential for plant establishment on this unit. Obtain a soil test for proper fertilizer management.

Building Site and Recreational Development

Management limitations:
- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Disturbing the soil increases the risk of erosion.
- Plant cover may be affected by the acidity and concentrations of heavy metals.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope.
- Stabilize disturbed areas to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Select plants adapted to high levels of soil acidity and high concentrations of heavy metals in establishing a plant cover.

Interpretive Groups

Capability class: VIIe

87—Tigley family extremely gravelly loam, extremely acid, 60 to 80 percent slopes, gullied

Composition

Tigley and similar soils: 85 percent
Contrasting inclusions: 15 percent

Setting

Landscape position: South-facing breaklands
Slope range: 60 to 80 percent
Slope features: Convex
Elevation: 2,250 to 3,400 feet
Mean annual precipitation: 30 to 35 inches
Mean annual air temperature: 47 to 49 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 7 inches—brown and grayish brown extremely gravelly loam, extremely acid and very strongly acid, high concentrations of heavy metals
7 to 30 inches—pale brown and light yellowish brown very gravelly and extremely gravelly loam
30 to 48 inches—very pale brown extremely cobbly loam
48 inches—weathered metasedimentary bedrock

Soil Properties and Qualities

Depth class: Deep (40 to 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: Very low
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Very rapid
Hazard of water erosion: Very severe
Acidity: Extremely acid or very strongly acid in the surface layer

Inclusions

Contrasting inclusions:
- Very strongly acid Lotuspoint soils on south-facing ridges
- Very strongly acid Tigley soils on east- and west-facing slopes
- Very strongly acid, severely eroded soils similar to Honeyjones soils on north-facing convex slopes
- Areas of rock outcrop
- Gullied land

Use and Management

Major current uses:
- Mining activities
- Areas of this unit with slopes steeper than 70 percent are not suitable for most land uses.

Vegetation

Present vegetation: Redtop, blue elderberry, black hawthorn, Rocky Mountain maple, Utah honeysuckle, Lewis' mock orange, and common snowberry
- The presence of heavy metals and extremely high soil acidity have drastically reduced the natural plant succession and potential wood production. The normal habitat type is grand fir/mallow ninebark.
- Approximately 90 percent of this unit is devoid of vegetation.

Management limitations:
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.
- Livestock grazing is not feasible on this unit due to steepness of slope, lack of suitable forage vegetation, and concentration of heavy metals.
- Seeding and planting are limited by extremely steep slopes, large stones, low available water capacity, water erosion, extremely gravelly surface texture, and hot soil temperatures in summer.

Management practices:
- Stabilize eroded and gullied areas before seeding and planting.
- The application of nitrogen fertilizer and other soil amendments is essential for plant establishment on this unit. Obtain a soil test for proper fertilizer management.
- Use plants for revegetation that tolerate high acidity and concentrations of heavy metals, droughtiness, and hot summer temperatures.

Building Site and Recreational Development

Management limitations:
- Extremely steep slopes prohibit the use of construction equipment.
- Plant cover may be affected by the acidity and concentrations of heavy metals.
- Disturbing the soil increases the risk of erosion.
- Excavation increases the risk of soil slippage and landslides.

Management practices:
- Design and construct roads and trails to compensate for steepness of slope and large stones.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Stabilize all disturbed areas to reduce the risk of erosion, soil slippage, and landslides.
- Select plants adapted to high concentrations of heavy metals, high levels of soil acidity, hot summer temperatures, and droughtiness in establishing a plant cover.

Interpretive Groups

Capability class: VIIIe

88—Tigley-Hugus association, 30 to 65 percent slopes

Composition

Tigley and similar soils: 45 percent
Hugus and similar soils: 35 percent
Contrasting inclusions: 20 percent

Tigley

Setting

Landscape position: South- and west-facing foothills and dissected terrace escarpments (fig. 16)
Slope range: 30 to 65 percent
Slope features: Plane to convex
Elevation: 2,160 to 3,600 feet
Mean annual precipitation: 30 to 38 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—1 inch thick
0 to 3 inches—grayish brown gravelly loam
3 to 10 inches—yellowish brown gravelly loam
10 to 19 inches—light reddish brown cobbly loam
19 to 60 inches—reddish yellow and red extremely cobbly loam and very cobbly loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a mantle of loess and minor amounts of volcanic ash
Permeability: Moderately slow
Available water capacity: Low
Potential rooting depth: 60 inches or more
Rate of surface runoff: Rapid to very rapid
Hazard of water erosion: Severe

Hugus

Setting

Landscape position: North- and east-facing foothills and dissected terrace escarpments
Slope range: 30 to 65 percent
Slope features: Concave to plane
Elevation: 2,160 to 3,600 feet
Mean annual precipitation: 30 to 38 inches
Mean annual air temperature: 42 to 44 degrees F
Frost-free period: 80 to 110 days

Typical Profile

Organic mat—2-inches thick
0 to 4 inches—pale brown silt loam
4 to 15 inches—light yellowish brown silt loam
15 to 52 inches—pale brown, very pale brown, and yellow very gravelly silt loam
52 to 60 inches—yellow extremely gravelly silt loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Permeability: Moderately slow
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:
- Ahrs soils on east- and west-facing convex slopes
- Lotuspoint soils on south-facing convex slopes and ridges
- Honeyjones soils on north-facing slopes
- Pinecreek soils on south-facing convex slopes
- Hobo and Helmer soils on lesser sloping toeslopes and terraces

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Tigley

Woodland suitability subclass: 8R
Trees suitable for planting: Douglas-fir and ponderosa pine
Mean site index:
Grand fir—79 (50-year site curve)
Douglas-fir—75 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—112 cubic feet at 108 years of age
Douglas-fir—71 cubic feet at 100 years of age

Figure 16.—An area of Tigley-Hugus association, 30 to 65 percent slopes, on foothills along the St. Joe River.

Dominant vegetation in potential natural plant community: Grand fir, Douglas-fir, ponderosa pine, western white pine, western larch, goldthread, queencup beadlily, and common snowberry

Hugus

Woodland suitability subclass: 9R
Trees suitable for planting: Grand fir, western white pine, and Douglas-fir
Mean site index:
Grand fir—90 (50-year site curve)
Western white pine—76 (50-year site curve)
Douglas-fir—87 (50-year site curve)
Western larch—77 (50-year site curve)
Estimated average annual production (CMAI):
Grand fir—133 cubic feet at 96 years of age
Western white pine—146 cubic feet at 100 years of age
Douglas-fir—97 cubic feet at 92 years of age
Western larch—116 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Western hemlock, western red cedar, western white pine, grand fir, Douglas-fir, western larch, lodgepole pine, wild ginger, queencup beadlily, and myrtle pachystima
Management limitations:
- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.

- Constructing roads at midslope results in large cuts and fills, which increase the risk of erosion.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.

Management practices:

- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Reduce the risk of erosion by avoiding excessive disturbance on the Tigley soil.

Grazeable Understory

Tigley

Common forest understory plants: Columbia brome, longtube twinflower, queencup beadlily, goldthread, American trailplant, Piper's anemone, starry false Solomon's seal, Rocky Mountain maple, myrtle pachystima, common snowberry, white spirea, baldhip rose, and Saskatoon serviceberry

Total production of air-dry vegetation (pounds per acre): 250

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 10 to 20 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 250 pounds per acre as the canopy closes.

Hugus

Common forest understory plants: Goldthread, longtube twinflower, queencup beadlily, myrtle pachystima, wild ginger, Utah honeysuckle, Oregon fairybells, American trailplant, darkwoods violet, baldhip rose, oneleaf foamflower, starry false Solomon's seal, and bunchberry dogwood

Total production of air-dry vegetation (pounds per acre): 100

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 5 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 100 pounds per acre as the canopy closes.

Management limitations:

- Slope may cause livestock distribution problems.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.

Building Site and Recreational Development

Management limitations:

- Steepness of slope limits the use of this unit for building site development.
- Slope limits the use of construction equipment.
- Excavation increases the risk of water erosion.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.

Management practices:

- Design and construct roads to compensate for the steepness of slope and large stones.
- Stabilize disturbed areas on the Tigley soil to reduce the risk of erosion and the maintenance costs resulting from erosion.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.

Watershed

- Manage this unit to keep soil erosion to a minimum, which helps maintain its value as watershed.
- Minimize soil erosion by careful management of timber and understory vegetation.

Interpretive Groups

Capability class: VIIe

89—Udarents, 0 to 4 percent slopes, frequently flooded

Composition

Udarents: 85 percent

Contrasting inclusions: 15 percent

- Udarents consist of areas of reclaimed stream dredgings from placer mining operations.

Setting

Landscape position: Flood plains and low stream terraces

Slope range: 0 to 4 percent

Slope features: Concave to convex
Elevation: 2,750 to 3,000 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Profile

0 to 10 inches—grayish brown and very pale brown gravelly loam
10 to 60 inches—variegated, stratified silt loam to extremely gravelly coarse sand

Soil Properties and Qualities

Depth class: Deep to sand, gravel, and cobbles
Drainage class: Somewhat poorly drained
Parent material: Mixed alluvium derived from metasedimentary rocks, mine tailings, mine dredgings, and slickens
Permeability: Moderate in the upper part and rapid to very rapid below
Available water capacity: Low
Potential rooting depth: 40 to 60 inches
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Depth to seasonal high water table: 36 to 54 inches—February through May; 54 to more than 60 inches—Rest of year
Hazard of flooding: Frequent: Brief—February through May

Inclusions

Contrasting inclusions:
- Pokey and Clarkia soils on undisturbed areas of flood plains
- Soils on disturbed areas that are poorly or very poorly drained

Use and Management

Major current uses:
- Pastureland
- Recreation
- Wildlife habitat

Hayland and Pastureland

- Adapted improved forage plants are timothy, orchardgrass, tall fescue, smooth brome, reed canarygrass, clover.

Management limitations:
- Wetness limits the choice of plants, limits the period of cutting or grazing, and increases the risk of winterkill.
- Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and lower forage production.

Management practices:
- Seed only forage plants that tolerate periodic inundation and seasonal wetness.
- Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding and wetness restrict building site and recreational development.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and flooding.
- The risk of seepage and the hazard of polluting the water supply limit the use of this unit as a septic tank absorption field.
- Cutbanks can cave because of the sandy substratum.
- Embankments are subject to piping, slumping, and seepage when saturated.

Management practices:
- Design and construct buildings and roads to compensate for flooding and seasonal wetness.
- Design and construct sanitary facilities to compensate for the hazard of seepage.
- Excavations should be designed to prevent cutbanks from caving.
- Susceptibility of the soil to slumping and piping when saturated requires special design of water retention structures.

Interpretive Groups

Capability class: Vw

90—Udarents-Aquic Udifluvents-Slickens complex, 0 to 4 percent slopes

Composition

Udarents: 40 percent
Aquic Udifluvents: 25 percent
Slickens: 20 percent
Contrasting inclusions: 15 percent

Udarents

Setting

Landscape position: Low stream terraces
Slope range: 0 to 4 percent
Slope features: Concave to convex

Elevation: 2,250 to 3,200 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 100 to 130 days

Typical Profile

0 to 26 inches—mixed and stratified layers of dark gray, pale brown, and pale yellow extremely gravelly fine sandy loam, very gravelly loamy fine sand, and extremely gravelly very fine sandy loam, high concentrations of heavy metals
26 to 50 inches—mottled pale brown and reddish yellow silt loam, high concentrations of heavy metals
50 to 60 inches—mottled very pale brown and pale yellow stratified, very fine sandy loam to extremely gravelly fine sand, high concentrations of heavy metals

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Mixed alluvium derived from metasedimentary rocks, mine tailings, mine dredgings, and slickens
Permeability: Moderate in the upper part and moderately rapid to very rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Hazard of wind erosion: Very severe
Depth to seasonal high water table: 36 to 54 inches—February through April; 54 to more than 60 inches—Rest of year
Hazard of flooding: Rare

Aquic Udifluvents

Setting

Landscape position: Flood plains and low stream terraces (fig. 17)
Slope range: 0 to 4 percent
Slope features: Plane to convex
Elevation: 2,250 to 3,200 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Typical Profile

0 to 7 inches—pale brown fine sandy loam, high concentrations of heavy metals
7 to 60 inches—stratified, variegated silt loam to extremely gravelly coarse sand, high concentrations of heavy metals

Soil Properties and Qualities

Depth class: Moderately deep to sand, gravel, and cobbles
Drainage class: Somewhat poorly drained
Parent material: Mixed alluvium derived from metasedimentary rocks mixed with slickens and mine tailings in some areas
Permeability: Moderately rapid in the upper part and moderate to very rapid below
Available water capacity: Low
Potential rooting depth: 20 to 40 inches
Rate of surface runoff: Slow
Hazard of water erosion: Slight
Hazard of wind erosion: Severe
Depth to seasonal high water table: 18 to 30 inches—February through May; 30 to more than 60 inches—Rest of year
Hazard of flooding: Frequent: Brief—February through May

Slickens

Setting

Landscape position: Flood plains and low stream terraces
Slope range: 0 to 4 percent
Slope features: Concave to convex
Elevation: 2,250 to 3,200 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 100 to 130 days

- Slickens consists of areas of accumulations of coarse- to medium-textured ground rock that has commonly undergone chemical treatment during the ore-milling process. Slickens not confined in specially constructed basins may be mixed with alluvium.

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained and somewhat poorly drained
Permeability: Moderate to very rapid
Rate of surface runoff: Slow
Hazard of water erosion: Severe (channelization during occasional flooding)
Hazard of wind erosion: Very severe
Depth to seasonal high water table: 18 to 54 inches—

Figure 17.—An area of Udarents-Aquic Udifluvents-Slickens complex, 0 to 4 percent slopes, on flood plains along the South Fork of the Coeur d'Alene River in the Silver Valley area. Pinecreek-Lotuspoint complex, strongly acid, 35 to 65 percent slopes, eroded, is in the background.

February through May; 54 to more than 60 inches—Rest of year

Hazard of flooding: Occasional: Brief—January through May

- Areas of slickens are detrimental to plant growth because of the high concentrations of heavy metals and are not suitable for most land uses.

Inclusions

Contrasting inclusions:

- Very strongly acid Helmer soils on higher terraces
- Dumps and mine tailings
- Aquic Udifluvents, protected, on higher terraces in urban areas

Use and Management

Major current uses:

- Homesites and urban development
- Mining activities
- Recreation

Vegetation

- *Present vegetation on Udarents:* black cottonwood, willow, western river alder, quaking aspen, bearberry, pyramid spirea, blue elderberry,

Indianhemp dogbane, black hawthorn, common tansy, Columbia brome, and redtop
- *Present vegetation on Aquic Udifluvents*: black cottonwood, redosier dogwood, western river alder, willow, redtop, reed canarygrass, scouringrush horsetail, sedge, common tansy, and Canada goldenrod
- Approximately 30 percent of this unit is devoid of vegetation.

Management limitations:
- High acidity and concentrations of heavy metals limit the kind and amount of vegetation produced on this unit.
- Livestock grazing is not feasible on this unit due to lack of suitable forage vegetation and concentration of heavy metals.
- Seeding and planting are limited by the toxic areas of slickens, concentrations of heavy metals, high acidity, flooding in some areas, and droughtiness during summer months.

Management practices:
- Use plants that tolerate high acidity and concentrations of heavy metals and, also, droughtiness during summer months.
- The application of nitrogen fertilizer and other soil amendments is essential for plant establishment on this unit. Obtain a soil test for proper fertilizer management.
- Suitable topsoil may need to be brought in to establish a plant cover.

Building Site and Recreational Development

Management limitations:
- Seasonal flooding, a high water table, and toxicity from heavy metals restrict building site and recreational development.
- Plant cover may be affected by the acidity and concentrations of heavy metals and, also, droughtiness during summer months.
- Embankments are subject to piping and slumping when saturated.
- Septic tank absorption fields can be expected to function poorly because of seasonal wetness and flooding.
- Cutbanks can cave because of the sandy substratum.
- The risk of seepage and the hazard of polluting the water supply limit the use of this unit for sewage disposal systems.
- The quality of roadbeds and road surfaces can be adversely affected by frost action on the Udarents and Aquic Udifluvents soils.
- Wind erosion is a problem during dry periods.

Management practices:
- Reduce wetness by providing suitably designed drainage ditches or tile drains.
- Reduce the risk of flooding by constructing levees and channels that have outlets for floodwater and by locating structures above the expected flood level.
- Reduce the risk of wind erosion by stabilizing areas that are barren or disturbed.
- Design and construct sewage disposal systems to compensate for seasonal wetness, flooding, and the hazard of seepage.
- Design and construct buildings and roads to compensate for seasonal wetness, flooding, and frost action.
- Excavations should be designed to prevent cutbanks from caving.
- Susceptibility of the soil to slumping and piping when saturated requires special design of water retention structures.
- Frequent irrigation of lawns, gardens, and most other plantings is needed because of the low available water capacity of the soil.
- Select adapted plants in establishing lawns, shrubs, trees, and gardens.
- Suitable topsoil may need to be brought in to replace toxic soil.

Interpretive Groups

Capability class:
Udarents—VIs
Aquic Udifluvents—Vw
Slickens—VIIIs

91—Vaywood silt loam, 15 to 35 percent slopes

Composition

Vaywood and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: Mountain ridges
Slope range: 15 to 35 percent
Slope features: Convex
Elevation: 4,800 to 6,500 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—1.75-inches thick
0 to 5 inches—brown silt loam

5 to 20 inches—pale brown silt loam
20 to 44 inches—pale brown and very pale brown very gravelly loam and very cobbly sandy loam
44 to 60 inches—very pale brown extremely cobbly sandy loam and extremely stony sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderate to moderately rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium
Hazard of water erosion: Slight

Inclusions

Contrasting inclusions:
- Latour soils on steeper slopes
- Bouldercreek soils on north-facing slopes at lower elevations
- Daveggio soils on east- and west-facing slopes at lower elevations
- Soils with bedrock at depths of 40 to 60 inches and more than 35 percent rock fragments throughout on north-facing slopes
- Areas of rock outcrop

Use and Management

Major current uses:
- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 6F
Trees suitable for planting: Engelmann spruce and subalpine fir
Mean site index:
Subalpine fir—90 (100-year site curve)
Engelmann spruce—97 (100-year site curve)
Western larch—53 (50-year site curve)
Estimated average annual production (CMAI):
Subalpine fir—90 cubic feet at 90 years of age
Engelmann spruce—104 cubic feet at 90 years of age
Western larch—69 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, Engelmann spruce, western larch, rustyleaf menziesia, common beargrass, queencup beadlily, big blueberry, and in some areas, mountain hemlock
Management limitations:
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.
- Areas on ridges that are exposed to strong, persistent, cold winds are less productive than other areas.

Management practices:
- Use conventional methods in harvesting timber.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Rustyleaf menziesia, common beargrass, Piper's anemone, western rattlesnake plantain, darkwoods violet, sidebells shinleaf, common prince's pine, Utah honeysuckle, queencup beadlily, myrtle pachystima, and big blueberry
Total production of air-dry vegetation (pounds per acre): 400
Livestock grazing:
- This unit can produce forage for livestock and big game animals for 10 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 400 pounds per acre as the canopy closes.

Management limitations:
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.

Management practices:
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.

Building Site and Recreational Development

Management limitations:
- Slope in some areas may limit the use of construction equipment.
- Slope limits the use of the steeper areas of this unit for site development.

- The quality of roadbeds and road surfaces can be adversely affected by frost action.
- Deep excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Deep cutbanks can cave because of the sandy substratum.
- The hazard of seepage may cause contamination of nearby streams from sanitary facilities.

Management practices:

- Design and construct roads and trails to compensate for slope.
- Design and construct roads to compensate for frost action and large stones.
- Deep excavations should be designed to prevent cutbanks from caving.
- Design and construct sanitary facilities to compensate for the hazard of seepage.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIe

92—Vaywood silt loam, cold, 35 to 75 percent slopes

Composition

Vaywood and similar soils: 75 percent
Contrasting inclusions: 25 percent

Setting

Landscape position: Mountain slopes
Slope range: 35 to 75 percent
Slope features: Convex
Elevation: 4,600 to 5,600 feet
Mean annual precipitation: 50 to 55 inches
Mean annual air temperature: 38 to 41 degrees F
Frost-free period: 30 to 60 days

Typical Profile

Organic mat—1.75-inches thick
0 to 5 inches—brown silt loam
5 to 20 inches—pale brown silt loam
20 to 44 inches—pale brown and very pale brown very gravelly loam and very cobbly sandy loam
44 to 60 inches—very pale brown extremely cobbly sandy loam and extremely stony sandy loam

Soil Properties and Qualities

Depth class: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Permeability: Moderate in the upper part and moderate to moderately rapid below
Available water capacity: Moderate
Potential rooting depth: 60 inches or more
Rate of surface runoff: Medium to rapid
Hazard of water erosion: Moderate

Inclusions

Contrasting inclusions:

- Hugus, high precipitation soils on north-facing slopes at lower elevations
- Bouldercreek, high precipitation soils on north-facing slopes at lower elevations
- Soils with bedrock at depths of 40 to 60 inches and more than 35 percent rock fragments throughout on north-facing slopes
- Areas of rock outcrop and rubble land

Use and Management

Major current uses:

- Timber production
- Livestock grazing
- Recreation
- Wildlife habitat
- Watershed

Woodland

Woodland suitability subclass: 6R
Trees suitable for planting: Subalpine fir and Engelmann spruce
Mean site index:
Subalpine fir—90 (100-year site curve)
Engelmann spruce—97 (50-year site curve)
Western larch—53 (50-year site curve)
Estimated average annual production (CMAI):
Subalpine fir—90 cubic feet at 90 years of age
Engelmann spruce—104 cubic feet at 90 years of age
Western larch—69 cubic feet at 70 years of age
Dominant vegetation in potential natural plant community: Subalpine fir, mountain hemlock, Engelmann spruce, western larch, rustyleaf

menziesia, common beargrass, queencup beadlily, and big blueberry

Management limitations:

- Steepness of slope restricts the use of wheeled and tracked equipment on skid trails.
- Disturbing the soil excessively when harvesting timber and building roads increases the loss of soil, which in turn leaves a greater number of rock fragments on the surface.
- The excavated cobbles and stones from road building can damage vegetation. The excavated soil material can also be a potential source of sedimentation.
- Road cutbanks are occasionally subject to caving.
- When openings are made in the canopy, invading brushy plants can delay natural reforestation.

Management practices:

- Use high-lead or other cable logging that fully or partially suspends logs because it is less damaging to the soil.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by back-hauling excavated soil and placing it on less sloping sites. These sites should be seeded.
- Stabilize road cutbanks to avoid the hazard of caving.
- Prepare the site carefully to control competing brushy vegetation.

Grazeable Understory

Common forest understory plants: Rustyleaf menziesia, common beargrass, Piper's anemone, western rattlesnake plantain, darkwoods violet, sidebells shinleaf, common prince's pine, Utah honeysuckle, queencup beadlily, myrtle pachystima, and big blueberry

Total production of air-dry vegetation (pounds per acre): 400

Livestock grazing:

- This unit can produce forage for livestock and big game animals for 10 to 15 years after the canopy is opened by logging, fire, or some other disturbance. During this period, annual production ranges from 2,000 pounds of air-dry forage per acre to less than 400 pounds per acre as the canopy closes.

Management limitations:

- Slope may cause livestock distribution problems.
- Thick brush can invade when the canopy is opened and may limit forage and access by livestock.
- Cold temperatures and a short growing season limit the kind of forage plants that will grow on this unit.

Management practices:

- Fences, stock trails, water developments, salting, and herding can be used to improve distribution of livestock grazing on steep slopes and rough terrain.
- Manage trees and shrubs by clearing or thinning to create open areas for forage production.
- This unit is best suited for livestock grazing during summer and early fall because cold temperatures delay production of forage.

Building Site and Recreational Development

Management limitations:

- Slope limits the use of construction equipment.
- Excavation is hampered by stones and cobbles in the soil.
- Unless an adequate wearing surface is maintained, stones and cobbles in the soil may create road hazards and increase maintenance costs.
- Road cutbanks are subject to caving.

Management practices:

- Design and construct roads and trails to compensate for steepness of slope.
- Avoid excessive damage to the soil and to the vegetation downslope from road-building sites by removing excavated waste material.
- Design and construct roads to compensate for large stones.
- Excavations should be designed to prevent cutbanks from caving.

Watershed

- Manage this unit to keep soil disturbance to a minimum, which helps maintain its value as watershed.
- Because of the risk of seepage, avoid the use of hazardous materials near streams to preserve water quality.

Interpretive Groups

Capability class: VIIe

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Interpretative ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Hay and Pasture

R. Susan Burnworth, Area Range Conservationist, Natural Resources Conservation Service, helped prepare this section.

General management needed for hay and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, and the estimated yields of hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

The St. Joe Area contains approximately 50,000 acres of nonirrigated hayland and pasture. The majority of land used for hayland and pasture (fig. 18) is located adjacent to the major rivers in the survey area. Hayland and pasture fields are relatively small and are grown in combination with a livestock operation. A combination of adapted grasses and legumes are generally used along with a small acreage of alfalfa hay. Typical management of the area is to harvest one or two cuttings of hay, then graze the fields with livestock throughout the summer and fall.

Many of the soils with potential for hayland and pasture along the South Fork of the Coeur d'Alene

Figure 18.—An area of Miesen-Ramsdell silt loams, 0 to 4 percent slopes, used for hay production.

River contain high amounts of heavy metals (U.S. Environmental Protection Agency, 1986). As a result, yields of hay and pasture grasses may be poor do to low fertility and toxicity of the soil. Soil testing is essential in this area to determine possible nutrient deficiencies or toxicity. Proper fertilizing and other soil amendments can then be applied to offset these problems and increase yields.

Frequent, or periodic, flooding of land adjacent to the rivers and streams in the survey area is an important limitation for growing hay or for pasture. Only plants that are adapted to a high water table and periodic flooding should be used. Livestock grazing must be controlled to prevent trampling and compaction of the soil when wet.

Many of the pastures in the survey area are small and susceptible to overgrazing. When fields are continually overgrazed throughout the year, production of good forage is reduced, fields are invaded by less palatable or weedy plants, and soil erosion occurs. Overgrazing fields adjacent to rivers and streams can cause streambank degradation, damage riparian vegetation, and reduce water quality downstream.

Improved management practices are needed to obtain high level yields of pasture. Suggested practices are controlled grazing systems, cross fencing, water developments, and allowing adequate periods for regrowth. The use of high-producing adapted plants and a fertilizer program are essential to achieve high yields. A fertilizer program should include

the application of nitrogen, phosphorus, and sulfur in accordance with soil test results.

Livestock grazing should be carefully controlled. Animals should not be allowed to graze in early spring when plants have not reached adequate growth, and the soils are wet. Grasses should not be grazed so close to the soil surface that they start regrowth from root-stored food reserves. For most grasses, leaving a stubble height of four inches will allow for rapid recovery.

Hayland management can be improved by using proper fertilizers as needed, cutting hay when it is at the proper protein content, and leaving an adequate amount of fall stubble to protect the plants.

Yields per Acre

The average yields per acre that can be expected of the hay and pasture plants under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of hay and pasture plants depends on the kind of soil and the plants. Management can include drainage, erosion control, and protection from flooding; proper planting and seeding rates; suitable high-yielding plant varieties; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements; and harvesting that ensures the smallest possible loss. Yields for dryland crops are based on a crop-fallow system.

The estimated yields reflect the productive capacity of each soil for hay and pasture plants. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system (USDA, 1961), soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I, there are no subclasses because the soils of this class have few limitations. Class V

contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, rangeland, woodland, wildlife habitat, or recreation.

Woodland Management and Productivity

Donald S. Larson, Area Forester, Natural Resources Conservation Service, helped prepare this section.

The timber industry in the St. Joe Area followed closely behind the mining industry of the Silver Valley in the late nineteenth century. Timber and lumber were needed for the mines and for the rapidly growing towns of Coeur d'Alene and Spokane. The magnificent stands of timber and their proximity to Lake Coeur d'Alene, making for easy transportation of the timber, was the impetus for the lumber industry in the area. The first sawmill was built at the confluence of the St. Joe and St. Maries rivers in 1889. Within a few years, mills were established throughout the entire area. Although there have been extreme fluctuations in the number of mills and the volume of lumber produced, the timber industry continues to remain one of the most important segments of the economy.

Tree species in the St. Joe Area include ponderosa pine, Douglas-fir, grand fir, western white pine, lodgepole pine, western hemlock, western red cedar, western larch, subalpine fir, Engelmann spruce, and some subalpine larch and mountain hemlock. Cottonwood, quaking aspen, and birch are found on the wetter soils and in riparian areas. Another species that is becoming commercially important is Pacific yew.

Much of the survey area is steep mountains with broad river bottoms. Logging methods are influenced by the steep terrain. Generally, slopes that exceed 35 percent are logged using cable or skyline skidding equipment. Using cable systems reduces the amount of ground needed for the placement of skid trails. On slopes less than 35 percent, ground skidding machines can be used in most situations; however, some of the soils may be susceptible to erosion, compaction, and displacement and must be managed carefully. Soils with surface layers that have developed in volcanic ash can be especially damaged by compaction if they are logged when wet.

Aspect, elevation, and soil characteristics influence the success of artificial regeneration. Brackenfern glades and alder stringers are present on many of the volcanic ash soils. In many instances, removal of the tree overstory has increased the area covered by brackenfern, and as a result, natural or artificial regeneration has been extremely difficult. Alder stringers appear on abandoned log roads and skid trails making tree regeneration and use of the road or skid trail difficult.

To prevent erosion and sedimentation of the soils, careful placement and construction of log roads and skid trails with erosion stabilization practices installed prior to use is necessary. Some of the soils in the survey area have subsoils that will erode rapidly when exposed during road building. Other soils in the survey area have fragipans or dense subsoils. A fragipan within the subsoil will hold a perched water table, making the soil wet for longer periods of time and more susceptible to compaction and displacement.

Woodland owners and forest managers can use table 6 to plan the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The ordination system is a nationwide uniform system of labeling soils or groups of soils that are similar in use and management. The primary factors evaluated in the woodland ordination system are productivity of the forest overstory tree species and the principal soil properties resulting in hazards and limitations that affect forest management. There are three parts of the ordination system—class, subclass, and group. The class and subclass are referred to as the ordination symbol.

The first element of the ordination symbol is a number that denotes potential productivity in terms of cubic meters of wood per hectare per year for the indicator tree species (that species listed first in table 6 for a particular map unit). The larger the number, the greater the potential productivity. Potential productivity is based on site index and the corresponding culmination of mean annual increment. For example, the number 1 indicates a potential production of 1 cubic meter of wood per hectare per year (14.3 cubic feet per acre per year), and 10 indicates a potential production of 10 cubic meters of wood per hectare per year (143 cubic feet per acre per year).

The second element, or subclass, of the ordination symbol is a capital letter that indicates certain soil or physiographic characteristics that contribute to important hazards or limitations to be considered in management. The letter *X* indicates excessive stoniness or rockiness; *W*, excessive water in or on the soil; *T*, toxic substances in the soil; *D*, restricted root depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, high content of coarse fragments in

the soil profile and *R*, steep slopes. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: *R, X, W, T, D, C, S*, and *F*.

In table 6, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil on a bare, disturbed soil. The risk is *slight* if there is little or no hazard of erosion, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive soil loss.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates that there is a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings are for seedlings from a good planting stock that are properly planted during a period of average rainfall. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Windthrow hazard is *slight* if trees in wooded areas are not expected to be blown down by commonly occurring winds, *moderate* if some trees are blown down during periods of excessive soil wetness and strong winds, and *severe* if many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Plant competition is *slight* if there is little or no competition from other plants; *moderate* if plant competition is expected to hinder the development of a fully stocked stand of desirable trees; and *severe* if plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *common trees* is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that forest land managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those trees that are suitable for commercial wood production and that are suited to the soils.

Woodland Understory Vegetation

Understory vegetation consists of forbs, grasses, shrubs, and other plants. If well managed, some forest land can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the age and kind of trees in the canopy, the density of the canopy, the depth and condition of the litter, the forest habitat type (Cooper and others, 1987), and the kind of soil. The density of the canopy determines the amount of light that understory plants receive.

Table 7 shows, for each soil suitable for woodland use, the potential for producing understory vegetation. The *total production* of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4.5 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimal part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 7 also lists the common names (USDA, 1982) of the *characteristic vegetation* on each soil and the *composition*, by percentage of air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of forest land in which the production of wood crops is highest.

Grazeable Woodland

By R. Susan Burnworth, Area Range Conservationist, Natural Resources Conservation Service.

Approximately 300,000 acres of woodland in the survey area are presently used for livestock grazing or have the potential to be grazed. Plants growing beneath the tree canopy are affected by the amount and quality of light they receive. In general, no usable forage is available in areas where the density of the canopy is 60 percent or more. In areas where timber stands are opened up by logging, fire, or other disturbance, usable forage can be produced for 5 to 25 years before the canopy closes again. The length

of time depends on the plant community, soils, climate, and other factors.

The quality and amount of understory forage vegetation diminish rapidly as the tree canopy begins to exceed 30 percent. In this survey area, the Bobbitt, Lacy, Lotuspoint, and Pinecreek soils have a fairly open canopy and are recommended for livestock grazing. Other soils may be used for grazing with certain limitations that are described in the soil map unit description.

A large portion of the Silver Valley area has been affected by past mining and smelting activities. As a result, the soils contain high concentrations of heavy metals and other toxic elements (U.S. Environmental Protection Agency, 1986) and do not produce sufficient vegetation for livestock forage. These disturbed soils, like Hugus gravelly loam, very strongly acid, 30 to 65 percent slopes, severely eroded should not be considered for livestock grazing.

Production of timber is the primary use of woodland soils, so livestock grazing should be managed to protect the timber resource. Grazing management systems should be designed to protect meadows and areas along rivers and streams. These are natural areas of concentration for livestock in a woodland grazing situation and are commonly in a depleted condition because of continual overuse.

The most important management practice is proper grazing use of selected key plant species. Planned grazing systems should be used that provide for periodic rest to allow key plants to mature and regrow. Good distribution of livestock grazing is difficult to achieve in woodland areas that are on steep slopes or that have thick brush in the understory. Management practices that improve grazing distribution include water development, access trails, fencing, and salting away from water and other concentration areas. Seeding disturbed areas with adapted plants greatly enhances the production of forage and reduces soil erosion.

Managing trees and shrubs by clearing or thinning creates open areas that will produce adequate forage for livestock use. Areas that have become infested with weeds or undesirable brush can be controlled with mechanical or chemical treatment.

Recreation

There are many opportunities for outdoor recreation in the St. Joe Area. The survey area includes three major rivers, the St. Joe, St. Maries, and the Coeur d'Alene, and many small lakes and streams. Fishing is good for all types of trout throughout the survey area. The St. Joe River is well known as a premier cutthroat fishery (USDA, 1974). There are good bear, deer, elk, moose, and mountain lion hunting opportunities. Grouse are plentiful, and some of the small lakes and streams provide waterfowl habitat.

Many public and private campgrounds, resorts, and access areas along the rivers provide excellent facilities for boating, fishing, and water sports. Silver Mountain ski resort, which overlooks the Silver Valley, is open from December to March. Opportunities for hiking and mountain biking are plentiful during the summer months.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. *Moderate* means the limitations can be overcome or modified by special planning, design, or maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in table 10 and interpretations for septic tank absorption fields in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not

dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones and boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand heavy foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones and boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Frank J. Fink, Biologist, Natural Resources Conservation Service, helped prepare this section.

The St. Joe Area supports a variety of game and nongame fish and wildlife populations. The quality of wildlife habitat ranges from excellent in the St. Joe River drainage to very poor along the South Fork of the Coeur d'Alene River in the Kellogg area. The South Fork area is unique and affected to a large extent by past development, mining, and smelter activities. Wildlife populations in this area are in a recovery mode.

Big game animals in the survey area are black bear, elk, moose, mule deer, and white-tailed deer. Elk are well suited to the area and are the dominant big game species. Most of the soils at an elevation below 4,800 feet provide summer and winter range for elk. Elk migrate to winter range on south- and west-facing slopes below 4,000 feet along the major river valleys. Creating new brush fields and rehabilitation of existing brush fields on these sites is critical to maintaining elk herds at current levels. Soils at elevations above 4,800 feet are used strictly for summer range.

Deer in the survey area include both white-tailed and mule deer. White-tailed deer comprise more than half of the total deer population. They occupy lower elevations along the river systems and valleys. Mule deer are more widely spread but will probably never be as numerous as white-tailed deer. This is because of competition from white-tailed deer and elk.

A variety of upland game bird species use all of the different habitat types in the survey area. Three species of forest grouse—blue, ruffed, and spruce—are in areas of forest land. Blue grouse move to higher elevations for wintering, but their nesting habitat is usually at lower elevations on open, grassy or brush-covered slopes and ridges. Ruffed grouse spend the summer in open clearings within wooded areas and then winter in the conifers.

Furbearers such as beaver, mink, muskrat, and otter live in and around creeks and streams in the survey area. Impact from past development, including mining and smelter activities along the South Fork of the Coeur d'Alene River, has restricted furbearer populations from becoming established in that area.

Coyote, fisher, lynx, martin, mountain lion, and wolverine are found in the survey area where appropriate conditions permit.

The survey area is not a major waterfowl area. Some open water areas and wetlands exist, and most nesting occurs along rivers, streams, and small lakes or ponds. Wet meadows within the foothills and mountains provide limited habitat for waterfowl.

Several raptors use the survey area for either all or part of their range. Some of the more common and highly visible raptors are the bald eagle, red-tailed hawk, goshawk osprey, and a variety of owls. Bald eagles are listed as an endangered species; unfortunately, there are no active nesting eagles in the survey area. However, bald eagles are a winter visitor and feed from ponds and rivers.

Westslope cutthroat and rainbow trout are the main sport fisheries in the major rivers of the survey area. Tributary streams contain significant spawning and rearing habitat for native cutthroat trout. Both water quality and riparian habitat have been degraded by past development and mining activities along the South Fork of the Coeur d'Alene River. As a result, the river, from along the town of Mullan and downstream

through the survey area, does not support a resident sport fishery.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. Soils also affect the construction of water impoundments. If food, cover, or water are missing, inadequate, or inaccessible, wildlife will be scarce or will not inhabit an area.

If the soils have potential for habitat development, wildlife habitat can be created or improved by planting appropriate vegetation, properly managing the existing plant cover, and fostering the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are available water capacity, depth of the root zone, flood hazard, slope, surface stoniness, texture of the surface layer, and wetness. Soil moisture and soil temperature are also considerations. Examples of grain and seed crops are barley, corn, rye, and wheat.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are available water capacity, depth of the root zone, flood hazard, slope, surface stoniness, texture of the surface layer, and wetness. Soil moisture and soil temperature are also considerations. Examples of grasses and legumes are alfalfa, bromegrass, clover, fescue, and lovegrass.

Wild herbaceous plants are native or naturally established forbs and grasses, including weeds. Soil properties and features that affect the growth of wild herbaceous plants are available water capacity, depth of the root zone, flood hazard, surface stoniness, texture of the surface layer, and wetness. Soil moisture and soil temperature are also considerations. Examples of wild herbaceous plants are blue wildrye, bluebunch wheatgrass, elk sedge, geranium, hawkweed, peavine, and pine reedgrass.

Coniferous plants furnish browse, cover, and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground covers are available water capacity, depth of the root zone, texture of the surface layer, and wetness. Examples of coniferous plants are cedar, fir, juniper, pine, and spruce.

Shrubs are bushy woody plants that produce bark, buds, foliage, fruit, and twigs. Soil properties and features that affect the growth of shrubs are available water capacity, depth of the root zone, salinity, and soil moisture. Examples of shrubs are baldhip rose, mountain blueberry, redstem ceanothus, and snowberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are reaction, salinity, slope, surface stoniness, texture of the surface layer, and wetness. Examples of wetland plants are cordgrass, reeds, rushes, saltgrass, sedges, smartweed, wild millet, and wild rice.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, permeability, slope, surface stoniness, and wetness. Examples of shallow water areas are marshes, ponds, and waterfowl feeding areas.

Habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, meadows, pasture, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to

these areas include cottontail rabbit, coyote, field sparrow, killdeer, meadowlark, partridge, and pheasant.

Habitat for woodland wildlife consists of areas of coniferous or deciduous trees and shrubs or a mixture of these and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include bear, deer, elk, gray fox, raccoon, ruffed grouse, squirrel, thrush, wild turkey, woodcock, and woodpecker.

Habitat for wetland wildlife consists of open, marshy or swampy, shallow-water areas. Some of the wildlife attracted to such areas are beaver, duck, geese, heron, mink, muskrat, and shore birds.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management (tables 10-13). Ratings are based on observed soil performance and on estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

Additional interpretations can be made using the information in the tables, along with soil maps, soil descriptions, and other data provided in this survey.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. Limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, open ditches, utility lines, and other purposes. Ratings are based on soil properties, site features, and observed soil performance. Ease of digging, filling,

and compacting is affected by the depth to bedrock, to a cemented pan, or to a very firm dense layer; stone content; soil texture; and slope. Depth to a seasonal high water table and susceptibility of the soil to flooding affect the time of year that excavations can be made. Soil texture and depth to the water table affect the resistance of the excavation walls or banks to sloughing or caving.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed soil performance. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed soil performance. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed soil performance. Soil reaction; a high water table; depth to bedrock or to a cemented pan; the available water capacity in the upper 40 inches; and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding; wetness; slope; stoniness; and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. This table also shows the suitability of the soils for use as a daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of *slight, moderate,* or *severe* are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of *good, fair,* and *poor* are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the soil. Only that part of the soil between depths of 24 and 72 inches is evaluated. Ratings are based on soil properties, site features, and observed soil performance. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious, soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Relatively impervious soil material for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. Ratings are based on soil properties,

site features, and observed soil performance. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed by burying in soil. There are two types of landfill—trench and area. In a trench landfill, waste is placed in successive layers on the surface of the soil. Waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation needs to be considered.

Ratings in table 11 are based on soil properties, site features, and observed soil performance. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated *slight* or *moderate* may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. Soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. Soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, most organic matter, and best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. Soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In table 12, soils are rated as a source of roadfill for low embankments, generally less than 6-feet high and less exacting in design than higher embankments.

Ratings are for soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. Table 14, "Engineering Index Properties," provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. Soil performance after it is stabilized with lime or cement is not considered in the ratings.

Ratings are based on soil properties, site features, and observed soil performance. Thickness of suitable material is a major consideration. Ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35-percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, slopes of more than 25 percent, or a water table at a depth of less than 1 foot. They may have layers of suitable material, but it is less than 3-feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the

probability of finding material in suitable quantity in or below the soil is evaluated. Neither the suitability of the material for specific purposes nor the factors that affect excavation of the material are evaluated.

Properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), thickness of suitable material, and content of rock fragments. Kinds of rock, acidity, and stratification are given in the taxonomic unit descriptions (see the "Classification of the Soils" section). Gradation of grain sizes is given in table 14, "Engineering Index Properties."

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12-percent silty fines. This material must be at least 3-feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Fragments of soft bedrock, such as shale and siltstone, are not considered sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Toxic material and such properties as soil reaction, available water capacity, and fertility affect plant growth. Slope, the water table, rock fragments, soil texture, and thickness of suitable material affect ease of excavating, loading, and spreading. Slope, the water table, rock fragments, bedrock, and toxic material affect reclamation of the borrow area.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils; loamy soils that have a relatively high content of clay; soils that have only 20 to 40 inches of suitable material; soils that have an appreciable amount of gravel, stones, or soluble salts; or soils that have slopes of 8 to 15 percent. Soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey; have less than 20 inches of suitable material; have a large amount of gravel, stones, or soluble salts; have slopes of more than 15 percent; or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information about soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. Limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. Seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20-feet high, constructed to impound water or to protect land against overflow. In table 13, soils are rated as a source of material for embankment fill. Ratings apply to soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

Ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material and trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to

bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving affect excavating and grading and the stability of ditchbanks. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. Depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope affect the design and management of an irrigation system. Large stones and depth to bedrock or to a cemented pan affect the construction of a system. Depth of the root zone, the amount of salts or sodium, and soil reaction affect the performance of a system.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. Restricted rooting depth, severe hazard of soil blowing or water erosion, excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of a soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

Estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series in the "Classification of the Soils" section.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993; Portland Cement Association, 1962) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986; Portland Cement Association, 1962).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments 3 to 10 inches in diameter and larger than 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by

converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series) have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series in the "Classification of the Soils" section.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. Clay determines the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3-bar moisture tension. Weight is determined after drying the soil at 105 degrees C.

In table 15, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, rock fragments, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (up to 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soils to wind erosion and the amount of soil lost. Soils are grouped according to the amount of stable aggregates 0.84 millimeters in size. These are represented idealistically by USDA textural classes. Soils containing rock fragments can occur in any group.

1. Coarse sands, sands, fine sands, and very fine sands. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams that have more than 5 percent finely divided calcium carbonate. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if measures to control soil blowing are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if ordinary measures to control soil blowing are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils have less than 5 percent finely divided calcium carbonate. They are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.
8. Soils that are not subject to soil blowing because of rock fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various water and soil features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. They consist

chiefly of very deep, well-drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. They consist chiefly of moderately deep or deep, moderately well-drained or well-drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. They consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. They consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable months of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (chance of flooding in any year is 5 to 50 percent).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year when flooding is most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered is local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is a zone of saturation at the highest average depth during the wettest season. It is at least 6-inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Indicated in table 16 are depth to the seasonal high water table, the kind of water table, and the months of the year when the water table usually is highest.

An *apparent* water table is indicated by the level at which water stands in a freshly dug, unlined borehole after adequate time is allowed for adjustments in the surrounding soil.

A *perched* water table is one that is above an unsaturated zone in the soil. The basis for determining that a water table is perched may be general knowledge of the area. The water table is proven to be perched if the water level in a borehole is observed to fall when the borehole is extended.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates the water table is above the surface of the soil. “>than 6.0” indicates the water table is below a depth of 6 feet, or it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action.

It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well-drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

A *low* potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a *moderate* potential indicates that the soil is susceptible to the formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a *high* potential indicates that the soil is highly susceptible to the formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The corrosion rate of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The corrosion rate of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and soil acidity.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion, also expressed as *low, moderate,* or *high,* is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Andisols, from *ands*, meaning containing allophane.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Vitrand (*Vitr*, meaning volcanic glass, plus *and*, from Andisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Udivitrands (*udi*, meaning humid, plus *vitrand*, the suborder of the Andisols that contain volcanic glass).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Udivitrands.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is ashy over loamy-skeletal, mixed, frigid Typic Udivitrands.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series. An example is the Honeyjones series.

Soil Series and Their Morphology

In this section, each taxonomic unit recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series and taxonomic unit. A pedon, a small three-dimensional area of soil, that is typical of the taxonomic unit in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise indicated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series and taxonomic unit are described in the section "Detailed Soil Map Units."

Agatha Series

Depth class: Deep
Drainage class: Well drained

Landform: Canyonsides and escarpments
Parent material: Weathered material derived from basalt with a mantle of loess
Slope range: 5 to 65 percent
Elevation: 2,160 to 3,200 feet
Mean annual precipitation: 28 to 33 inches
Mean annual air temperature: 43 to 45 F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, frigid Ultic Haploxeralfs

Typical Pedon

Agatha stony loam, in an area of Agatha stony loam, 35 to 65 percent slopes, 2.25 miles southeast of St. Maries, Benewah County, 2,450 feet south and 1,000 feet east of the northwest corner of sec. 30, T. 46 N., R. 1 W.

Oi—2 to 1 inch; slightly decomposed needles, leaves, twigs, and moss.
Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 5 inches; brown (7.5YR 5/2) stony loam, dark brown (7.5YR 3/2) moist, weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, and few medium roots; many very fine and fine tubular pores; 10 percent pebbles, 10 percent cobbles, and 1 percent stones; about 0.1 percent stones on the surface; neutral (pH 7.0); clear wavy boundary.
Bt1—5 to 15 inches; brown (7.5YR 5/4) very cobbly loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; 10 percent pebbles, 25 percent cobbles, and 1 percent stones; common faint clay films on faces of peds and lining pores; neutral (pH 6.8); clear wavy boundary.
Bt2—15 to 27 inches; light brown (7.5YR 6/4) very cobbly loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; many very fine, fine, and few medium tubular pores; 20 percent pebbles, 20 percent cobbles, and 10 percent stones; many distinct and common faint clay films on faces of peds and lining pores; neutral (pH 6.8); gradual wavy boundary.
Bt3—27 to 38 inches; light yellowish brown (10YR 6/4) extremely stony clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky, and plastic; common very fine, fine, and medium and few coarse roots; many very fine, common fine, and few medium tubular pores; 25 percent pebbles, 25 percent cobbles, and 25 percent stones; many faint and common distinct clay films on faces of peds and lining pores; slightly acid (pH 6.4); gradual wavy boundary.
Bt4—38 to 48 inches; light yellowish brown (10YR 6/4) extremely stony clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky, and plastic; common very fine and fine and few medium roots; many very fine and common fine tubular pores; 25 percent pebbles, 30 percent cobbles, and 30 percent stones; many faint and few distinct clay films on faces of peds and lining pores; moderately acid (pH 6.0); abrupt wavy boundary.
R—48 inches; hard, fractured basalt bedrock.

Range in Characteristics

Depth to bedrock: 40 to 60 inches
Surface stones: 0.01 to 0.1 percent

A horizon:
Hue—10YR or 7.5YR
Chroma—2 or 3 dry or moist
Rock fragment content—15 to 25 percent
Thickness—3 to 9 inches
Reaction—slightly acid or neutral

BA horizon (present in some pedons):
Hue—10YR
Value—5 (3 moist)
Chroma—4 dry or moist
Texture—cobbly loam or cobbly silt loam
Rock fragment content—15 to 20 percent
Reaction—slightly acid or neutral

Bt horizons:
Chroma—3 or 4 dry or moist
Texture—very cobbly, extremely cobbly, very stony or extremely stony loam; silt loam or clay loam
Rock fragment content—35 to 65 percent in the upper part; 65 to 90 percent in the lower part
Base saturation—60 to 70 percent
Clay content—18 to 34 percent
Reaction—moderately acid to neutral

Ahrs Series

Depth class: Very deep
Drainage class: Well drained
Landform: Mountains
Parent material: Weathered material derived from metasedimentary bedrock primarily siltite and argillite with a mantle of volcanic ash
Slope range: 15 to 75 percent
Elevation: 2,200 to 4,800 feet
Mean annual precipitation: 30 to 42 inches
Mean annual air temperature: 42 to 46 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, frigid Typic Udivitrands

Typical Pedon

Ahrs gravelly silt loam, in an area of Ahrs-Pinecreek association, 35 to 75 percent slopes, 1.5 miles southeast of St. Joe Baldy, Benewah County,1,000 feet south and 2,000 feet east of the northwest corner of sec. 7, T. 46 N., R. 1 E.

Oi—2 to 1 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter.
A—0 to 6 inches; grayish brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky, and slightly plastic; many very fine and fine, common medium, and few coarse roots; many very fine and common fine tubular and irregular pores; 20 percent pebbles and 5 percent cobbles; neutral (pH 7.0); clear wavy boundary.
Bw1—6 to 18 inches; yellowish brown (10YR 5/4) very cobbly silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky, and slightly plastic; many very fine and fine, common medium, and few coarse roots; common very fine and fine tubular and irregular pores; 20 percent pebbles and 20 percent cobbles; neutral (pH 6.8); clear wavy boundary.
2Bw2—18 to 30 inches; light yellowish brown (10YR 6/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and fine and few medium tubular and irregular pores; 20 percent pebbles, 30 percent cobbles, and 15 percent stones; slightly acid (pH 6.5); clear wavy boundary.
2C1—30 to 46 inches; very pale brown (10YR 7/4) extremely cobbly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine and few medium and coarse roots; common very fine and fine and few medium tubular and irregular pores; 20 percent pebbles, 30 percent cobbles; and 15 percent stones; slightly acid (pH 6.5); gradual wavy boundary.
2C2—46 to 57 inches; very pale brown (10YR 7/4) extremely cobbly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; few very fine and fine roots; common very fine and fine tubular and irregular pores; 35 percent pebbles, 35 percent cobbles, and 15 percent stones; slightly acid (pH 6.4); gradual wavy boundary.
2C3—57 to 60 inches; very pale brown (10YR 7/4) extremely cobbly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; few very fine roots; common very fine and fine tubular pores; 35 percent pebbles, 40 percent cobbles, and 15 percent stones; slightly acid (pH 6.4).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 14- to 24-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Value—4 to 6 dry(2 to 4 moist)
Chroma—2 or 3 dry or moist
Rock fragment content—15 to 30 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—moderately acid to neutral

Bw horizon:
Hue—10YR or 7.5YR
Value—5 to 7 (3 to 5 moist)
Texture—very gravelly or very cobbly loam or silt loam
Rock fragment content—35 to 60 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—moderately acid to neutral

2Bw horizon:
Hue—10YR or 7.5YR
Value—6 or 7 (4 or 5 moist)
Texture—very gravelly, very cobbly, extremely gravelly, or extremely cobbly loam or silt loam

Rock fragment content—40 to 70 percent
Reaction—moderately acid to neutral

2C horizons:
Hue—10YR or 7.5YR
Value—6 or 7 (4 or 5 moist)
Chroma—3 to 6 dry and moist
Texture—extremely gravelly, extremely cobbly, or extremely stony loam or silt loam
Rock fragment content—65 to 90 percent
Reaction—strongly acid to slightly acid

Aquic Udifluvents

Depth class: Moderately deep to sand, gravel, and cobbles
Drainage class: Somewhat poorly drained
Positions on landscape: Flood plains and low stream terraces
Parent material: Mixed alluvium derived from metasedimentary rocks, mixed with slickens and mine tailings in some areas
Slope range: 0 to 4 percent
Elevation: 2,135 to 3,300 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 42 to 47 degrees F
Frost-free period: 90 to 120 days

Typical Pedon

Aquic Udifluvents, 0 to 4 percent slopes, 0.25 miles east of Pinehurst, Shoshone County, 1,800 feet south and 1,200 feet west of the northeast corner of sec. 5, T. 48 N., R. 2 E.

C1—0 to 6 inches; mixed very pale brown (10YR 7/4) and yellowish brown (10YR 5/4) silt loam, yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; common very fine roots; many very fine irregular pores; 5 percent pebbles; moderately acid (pH 6.0); abrupt smooth boundary.
Ab—6 to 10 inches; grayish brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; 15 percent pebbles and 5 percent cobbles; moderately acid (pH 6.0); clear smooth boundary.
C2—10 to 20 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; common thin stratified layers of yellowish brown (10YR 5/4) very fine sandy loam; few fine dark yellowish brown (10YR 4/6) iron stains; slightly acid (pH 6.3); abrupt smooth boundary.
2C3—20 to 37 inches; mixed light yellowish brown (10YR 6/4) and brownish yellow (10YR 6/6) very gravelly loamy sand, dark yellowish brown (10YR 4/4 and 10YR 4/6) moist; few fine distinct mottles that are dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots; many very fine and fine irregular pores; few very fine manganese concretions; common fine strong brown (7.5YR 4/6) iron stains; 50 percent pebbles and 10 percent cobbles; slightly acid (pH 6.3); gradual wavy boundary.
2C4—37 to 60 inches; pale brown (10YR 6/3) extremely cobbly loamy coarse sand, brown (10YR 4/3) moist; few fine distinct mottles that are dark grayish brown (10YR 4/2) when moist; single grain; loose; nonsticky, and nonplastic; no roots; many very fine and fine irregular pores; few very fine manganese and iron concretions; common fine strong brown (7.5YR 4/6) iron stains; 40 percent pebbles and 40 percent cobbles; slightly acid (pH 6.5).

Range in Characteristics

Depth to sand, gravel, and cobbles: 20 to 40 inches
Depth to high water table: 18 to 30 inches (February to May)

A horizon:
Value—5 or 6 (3 or 4 moist)
Chroma—2 to 4 dry or moist
Texture—stratified silt loam, very fine sandy loam, fine sandy loam, sandy loam, loamy fine sand or fine sand, and may be gravelly or very gravelly in some pedons
Pebble content—0 to 35 percent
Cobble content—0 to 10 percent
Reaction—moderately acid to neutral

C horizons:
Hue—variable
Value—5 to 8 (3 to 6 moist)
Chroma—2 to 6 dry or moist
Texture—stratified silt loam to extremely cobbly coarse sand
Pebble content—0 to 65 percent
Cobble content—0 to 65 percent
Reaction—moderately acid to neutral

Bechtel Series

Depth class: Deep
Drainage class: Well drained
Positions on landscape: Foothills
Parent material: Weathered material derived from sedimentary siltstone and shale with a mantle of loess and minor amounts of volcanic ash
Slope range: 20 to 40 percent
Elevation: 2,800 to 3,400 feet
Precipitation: 35 to 40 inches
Air temperature: 43 to 45 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Fine-loamy, mixed Vitrandic Glossoboralfs

Typical Pedon

Bechtel silt loam, in an area of Bechtel-Reggear silt loams, 20 to 40 percent slopes, .75 miles northwest of Emida, Benewah County, 1,500 feet north and 400 feet east of the southwest corner of sec. 28, T. 44 N., R. 2 W.

Oi—.5 inch to 0; slightly decomposed needles, leaves, and twigs.
A—0 to 5 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, nonsticky, and slightly plastic; many very fine, fine, and common medium and coarse roots; many very fine and fine tubular pores; 5 percent pebbles; slightly acid (pH 6.2); clear wavy boundary.
BA—5 to 12 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, and fine and few medium and coarse roots; common very fine and fine tubular pores; common fine brownish yellow (10YR 6/6) iron stains; 10 percent pebbles; moderately acid (pH 6.0); gradual wavy boundary.
Bt1—12 to 20 inches; very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky, and plastic; common very fine, and fine and few medium roots; common very fine and fine tubular pores; common faint clay films on faces of peds and lining pores; common fine brownish yellow (10YR 6/6) iron stains; 15 percent pebbles; slightly acid (pH 6.5); gradual wavy boundary.
Bt2—20 to 33 inches; very pale brown (10YR 7/4) gravelly loam, yellowish brown (10YR 5/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky, and plastic; common very fine, and fine and few medium roots; few very fine and fine tubular pores; common faint clay films on faces of peds and lining pores; 30 percent pebbles; moderately acid (pH 6.0); gradual wavy boundary.
BC—33 to 47 inches; mixed very pale brown (10YR 8/3) and pale yellow (2.5Y 8/4) very gravelly loam, pale brown (10YR 6/3) and light yellowish brown (2.5Y 6/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and plastic; few very fine and fine roots; few very fine and fine tubular pores; few fine brownish yellow (10YR 6/6) iron stains concentrated near boundary of Cr horizon; 50 percent pebbles; strongly acid (pH 5.5); clear wavy boundary.
Cr—47 inches; soft siltstone with fractures greater than 4 inches apart.

Range in Characteristics

Depth to bedrock: 40 to 60 inches

A horizon:
Value—5 or 6 dry (3 or 4 moist)
Pebble content—0 to 5 percent
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent
Reaction—slightly acid or neutral

Bt horizons:
Value—6 or 7 (4 or 5 moist)
Texture—silt loam, loam, gravelly loam, or gravelly silt loam
Pebble content—10 to 30 percent
Cobble content—lower part—0 to 5 percent
Clay content—20 to 26 percent
Base saturation—35 to 50 percent
Reaction—strongly acid to slightly acid

Bellslake Series

Depth class: Very deep
Drainage class: Very poorly drained
Landform: Concave areas of flood plains
Parent material: Alluvium and organic material derived from mixed sources
Slope range: 0 to 1 percent
Elevation: 2,120 to 2,140 feet
Average annual precipitation: 28 to 32 inches
Average annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Coarse-silty, mixed, nonacid, frigid Aquandic Humaquepts

Typical Pedon

Bellslake silt loam, in an area of Bellslake silt loam, 0 to 1 percent slopes, 3 miles northeast of St. Maries, Benewah County, 1,000 feet south and 2,300 feet west of the northeast corner of sec. 18, T. 46 N., R. 1 W.

Ag1—0 to 5 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; common fine and medium distinct and prominent mottles that are dark gray (5Y 4/1) and dark yellowish brown (10YR 3/4) when moist; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; common very fine and fine mica flakes; moderately acid (pH 6.0); abrupt wavy boundary.

Ag2—5 to 9 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; common fine and medium distinct and prominent mottles that are dark gray (5Y 4/1) and dark yellowish brown (10YR 3/4) when moist; weak very fine and fine granular structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; common very fine and fine mica flakes; moderately acid (pH 6.0); abrupt wavy boundary.

Agb—9 to 12 inches; mixed grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) mucky silt loam, very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) moist; few fine and medium distinct mottles that are dark olive gray (5Y 3/2) and dark yellowish brown (10YR 3/4) when moist; moderate fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; common very fine and fine mica flakes; 20 percent organic matter; moderately acid (pH 6.0); abrupt wavy boundary.

Bgb—12 to 27 inches; mixed light gray (2.5Y 7/2) and light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) moist; common fine and medium faint mottles that are very dark grayish brown (2.5Y 3/2) when moist and few fine prominent mottles that are dark yellowish brown (10YR 3/4) when moist; weak fine and medium subangular blocky structure; hard, firm, slightly sticky, and slightly plastic; few very fine and fine roots; few very fine tubular pores; many large organic stains that are black (2.5Y 2/0) when moist; common very fine and fine mica flakes; moderately acid (pH 6.0); clear wavy boundary.

A´gb—27 to 38 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; common fine and medium distinct mottles that are dark grayish brown (2.5Y 4/2) when moist; weak fine and medium subangular blocky structure; hard, firm, slightly sticky, and slightly plastic; few very fine roots; few very fine tubular pores; common fine and medium organic stains that are black (2.5Y 2/0) when moist; common very fine and fine mica flakes; moderately acid (pH 6.0); abrupt wavy boundary.

Oa—38 to 42 inches; sapric material that is very dark brown (10YR 2/2) on broken face and when rubbed; common fine faint mottles that are very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) when moist; about 50 percent primarily herbaceous fibers, about 5 percent after rubbing; massive; slightly plastic; about 40 percent mineral material; moderately acid (pH 6.0); abrupt wavy boundary.

Oe—42 to 60 inches; hemic material that is dark gray (10YR 4/1) on broken face and when rubbed; about 80 percent primarily herbaceous fibers, about 50 percent after rubbing; massive; about 10 percent mineral material; moderately acid (pH 6.0).

Range in Characteristics

Umbric epipedon thickness: 10 to 20 inches
Depth to high water table: +12 to 18 inches (October to August)

Ag horizons:
- Hue—5Y, 2.5Y, or 10YR;
- Value—5 or 6 (3 or 4 moist)
- Chroma—0 through 2 dry and moist
- Mottles—faint to prominent; hue: 5Y, 2.5Y, 10YR, or 7.5YR; value: 2 through 4 moist; chroma: 0 through 6 moist
- Thin discontinuous layers— fine sandy loam present in some pedons
- Volcanic glass content—5 to 20 percent
- Phosphate retention—25 to 55 percent
- Base saturation—35 to 50 percent
- Reaction—strongly acid or moderately acid

Agb horizon:
- Chroma—1 or 2 dry and moist
- Mottles—faint to prominent; hue: 5Y, 2.5Y, 10YR, or 7.5YR; value: 3 through 5 moist; chroma: 0 through 6 moist

Texture—silt loam or mucky silt loam
Base saturation—35 to 50 percent
Reaction—strongly acid or moderately acid

Bgb horizon:
Hue—5Y, 2.5Y, or 10YR
Chroma—1 or 2 dry and moist
Mottles—faint to prominent; hue: 2.5Y, 10YR, or 7.5YR; value: 2 through 4 moist; chroma: 0 through 6 moist
Reaction—strongly acid or moderately acid

Oa and Oe horizons:
Hue—7.5YR or 10YR
Reaction—moderately acid or slightly acid

Blackprince Series

Depth class: Moderately deep
Drainage class: Well drained
Landform: Canyonsides and foothills
Parent material: Weathered material derived from gneiss or granitic bedrock with minor amounts of loess and volcanic ash in the upper part
Slope range: 35 to 75 percent
Elevation: 2,200 to 4,000 feet
Average annual precipitation: 30 to 38 inches
Average annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Loamy-skeletal, mixed, frigid Dystric Xerochrepts

Typical Pedon

Blackprince, in an area of Jacot-Blackprince complex, 35 to 65 percent slopes, 0.5 mile north of Marble Creek, Shoshone County, 1,900 feet north and 700 feet east of the southwest corner of sec. 12, T. 45 N., R. 3 E.

Oi—1.5 to 1.0 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 3 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable, nonsticky, and slightly plastic; many very fine and fine and common medium roots; many very fine and fine irregular and common fine tubular pores; 20 percent pebbles; neutral (pH 6.7); clear wavy boundary.
BA—3 to 11 inches; pale brown (10YR 6/3) gravelly sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, and fine and few medium and coarse roots; many very fine and fine tubular and irregular pores; 20 percent pebbles; slightly acid (pH 6.5); gradual wavy boundary.
Bt—11 to 22 inches; very pale brown (10YR 7/4) very gravelly coarse sandy loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, and few medium roots; many very fine and fine irregular and few fine tubular pores; few faint clay films on faces of peds and common faint clay films lining pores; 35 percent pebbles; moderately acid (pH 5.6); abrupt wavy boundary.
C—22 to 28 inches; variegated very gravelly loamy coarse sand; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots; many fine and medium irregular pores; 60 percent pebbles; strongly acid (pH 5.3); abrupt wavy boundary.
Cr—28 inches; soft weathered granitic bedrock.

Range in Characteristics

Depth to bedrock: 20 to 40 inches
Base saturation: 35 to 60 percent

A horizon:
Hue—10YR or 7.5YR
Chroma—2 or 3 dry or moist
Pebble content—15 to 25 percent
Clay content—6 to 12 percent
Reaction—slightly acid or neutral

BA horizon:
Hue—10YR or 7.5YR
Value—6 or 7 (4 or 5 moist)
Chroma—3 or 4 dry or moist
Texture—gravelly sandy loam or gravelly coarse sandy loam
Pebble content—15 to 35 percent
Clay content—6 to 12 percent
Reaction—slightly acid or neutral

Bt horizon:
Hue—10YR or 7.5YR
Texture—very gravelly coarse sandy loam or very gravelly sandy loam
Pebble content—35 to 45 percent
Clay content—6 to 12 percent
Reaction—moderately acid to neutral

C horizon:
Hue—10YR, 7.5YR, or variegated
Value—7 or 8 (5 or 6 moist)
Chroma—2 through 4 dry or moist

Texture—very gravelly loamy coarse sand or very gravelly loamy sand
Pebble content—40 to 60 percent
Cobble content—0 to 10 percent
Reaction—strongly acid to slightly acid

Bobbitt Series

Depth class: Moderately deep
Drainage class: Well drained
Landform: Escarpments and canyonsides
Parent material: Weathered material derived from basalt with a loess mantle
Slope range: 35 to 65 percent
Elevation: 2,150 to 3,200 feet
Average annual precipitation: 28 to 33 inches
Average annual air temperature: 47 to 49 degrees F
Frost-free period: 100 to 130 days

Taxonomic Class: Loamy-skeletal, mixed, mesic Ultic Argixerolls

Typical Pedon

Bobbitt, in an area of Lacy-Bobbitt stony loams, 35 to 65 percent slopes, 1.5 miles east of St. Maries, Benewah County, 400 feet south and 2,350 feet west of the northeast corner of sec. 25, T. 46 N., R. 2 W.

Oi—2 to 1 inch; needles, twigs, leaves, cones, and moss mixed with Mt. St. Helens ash.
Oe—1 inch to 0; decomposed organic matter.
A1—0 to 3 inches; brown (7.5YR 5/2) stony loam, dark brown (7.5YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, common fine and medium, and few coarse roots; many very fine and fine tubular pores; 10 percent pebbles, 5 percent cobbles, and 5 percent stones; about 0.1 percent stones on the surface; neutral (pH 7.0); clear wavy boundary.
A2—3 to 12 inches; brown (7.5YR 5/2) stony loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure parting to moderate very fine and fine granular; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine and fine and few medium tubular pores; 10 percent pebbles, 10 percent cobbles, and 10 percent stones; neutral (pH 7.0); clear wavy boundary.
Bt1—12 to 18 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 3/3) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky, and plastic; common very fine, fine, and medium and few coarse roots; common very fine, and fine and few medium tubular pores; 15 percent pebbles, 25 percent cobbles, and 10 percent stones; common distinct clay films on faces of peds and lining pores; neutral (pH 6.8); clear wavy boundary.
Bt2—18 to 32 inches; pale brown (10YR 6/3) very cobbly clay loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky, and plastic; common very fine, fine, and medium roots; common very fine and few fine and medium tubular pores; 15 percent pebbles, 30 percent cobbles, and 15 percent stones; common distinct clay films on faces of peds and lining pores; neutral (pH 6.8); abrupt irregular boundary.
R—32 inches; hard, fractured basalt.

Range in Characteristics

Depth to bedrock: 20 to 40 inches
Mollic epipedon: 10 to 18 inches
Surface stones: 0.01 to 0.1 percent
Reaction: Slightly acid or neutral

A horizons:
Hue—10YR or 7.5YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 or 3 dry or moist
Rock fragment content—15 to 30 percent

Bt horizons:
Hue—10YR or 7.5YR
Chroma—3 or 4 dry or moist
Texture—very cobbly, very stony, extremely cobbly, extremely stony loam or clay loam
Clay content—22 to 34 percent
Rock fragment content—35 to 80 percent
Base saturation—50 to 60 percent

Bouldercreek Series

Depth class: Very deep
Drainage class: Well drained
Landform: Mountains
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Slope range: 15 to 75 percent
Elevation: 2,600 to 5,000 feet
Average annual precipitation: 35 to 50 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Ashy over loamy-skeletal, mixed, frigid Typic Udivitrands

Typical Pedon

Bouldercreek silt loam, in an area of Bouldercreek silt loam, 35 to 65 percent slopes, 2.5 miles southeast of Herrick, Shoshone County, 2,250 feet north and 50 feet east of the southwest corner of sec. 21, T. 45 N., R. 3 E.

Oi—2.5 to 1.5 inches; slightly decomposed needles, leaves, and twigs.
Oe—1.5 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 2 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine, fine, and medium and common coarse roots; many very fine tubular pores; neutral (pH 6.8); clear wavy boundary.
Bw1—2 to 15 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; 5 percent pebbles and 5 percent cobbles; neutral (pH 6.8); clear wavy boundary.
2Bw2—15 to 26 inches; light yellowish brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine, fine, medium and few coarse roots; common very fine and fine tubular pores; 50 percent pebbles and 10 percent cobbles; slightly acid (pH 6.5); gradual wavy boundary.
2BC—26 to 43 inches; very pale brown (10YR 7/4) extremely gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky, and nonplastic; common very fine, fine, and medium roots; many very fine and fine irregular pores; many very fine mica flakes; 65 percent pebbles and 10 percent cobbles; moderately acid (pH 6.0); gradual wavy boundary.
2C—43 to 60 inches; mixed very pale brown (10YR 7/4) and pink (7.5YR 7/4) extremely gravelly sandy loam, yellowish brown (10YR 5/4) and brown (7.5YR 5/4) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots; many very fine and fine irregular pores; many very fine mica flakes; 55 percent pebbles, 10 percent cobbles, and 10 percent stones; moderately acid (pH 6.0).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 14- to 20-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Hue - 10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—2 to 4 dry or moist
Pebble content—0 to 10 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

Bw horizon:
Hue - 10YR or 7.5YR
Value - 5 to 7 (3 to 5 moist)
Texture—silt loam or gravelly silt loam
Rock fragment content—5 to 25 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

2Bw horizon:
Hue—10YR or 7.5YR
Value—6 or 7 (4 or 5 moist)
Chroma—3 or 4 dry or moist
Texture—very gravelly or very cobbly loam, fine sandy loam, or sandy loam
Rock fragment content—35 to 60 percent
Reaction—moderately acid to neutral

2C horizon:
Value—6 to 8 (4 to 6 moist)
Chroma—3 or 4 dry or moist
Texture—extremely gravelly, extremely cobbly, or extremely stony sandy loam, fine sandy loam, or loamy fine sand
Rock fragment content—70 to 85 percent
Reaction—moderately acid to neutral

Clarkia Series

Depth class: Very deep
Drainage class: Poorly drained
Landform: Flood plains, low stream terraces, and drainageways
Parent material: Alluvium derived from mixed sources
Slope range: 0 to 2 percent
Elevation: 2,700 to 3,200 feet
Average annual precipitation: 35 to 45 inches
Average annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Fine-silty, mixed, frigid Aquandic Endoaqualfs

Typical Pedon

Clarkia silt loam, in an area of Clarkia silt loam, 0 to 2 percent slopes, 4 miles northwest of Clarkia, Shoshone County, 1,300 feet south and 1,200 feet east of the northwest corner of sec. 27, T. 43 N., R. 1 E.

A—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and fine roots; many very fine tubular pores; moderately acid (pH 5.6); clear wavy boundary.

BA—8 to 15 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; few fine distinct mottles that are dark grayish brown (10YR 4/2) when moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; moderately acid (pH 5.6); gradual wavy boundary.

Bt—15 to 25 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; common fine distinct and prominent mottles that are dark grayish brown (10YR 4/2) and strong brown (7.5YR 5/6) when moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky, and plastic; many very fine and fine roots; many very fine and fine tubular pores; few faint clay films on faces of peds and lining pores; few fine iron and manganese concretions; moderately acid (pH 5.8); gradual wavy boundary.

Btg—25 to 32 inches; pale yellow (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; common fine prominent mottles that are strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) when moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; few faint clay films on faces of peds and lining pores; few fine iron and manganese concretions; moderately acid (pH 5.6); gradual wavy boundary.

Cg1—32 to 49 inches; pale yellow (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; common fine prominent mottles that are strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) when moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; few very fine iron and manganese concretions; slightly acid (pH 6.2); abrupt wavy boundary.

Cg2—49 to 62 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; many medium prominent mottles that are strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) when moist; massive; hard, firm, sticky, and plastic; few very fine tubular pores; few very fine iron and manganese concretions; slightly acid (pH 6.4).

Range in Characteristics

Depth to high water table: 18 to 24 inches (February to June)
Reaction: Moderately acid to slightly acid

A horizon:
- Value—4 or 5 (2 or 3 moist)
- Chroma—1 to 3 dry or moist
- Base saturation—35 to 50 percent
- Volcanic glass content—5 to 20 percent
- Phosphate retention—25 to 55 percent

BA horizon:
- Value—6 or 7 (4 or 5 moist)
- Chroma—3 or 4 dry or moist

Bt horizon:
- Value—6 or 7 (4 or 5 moist)
- Mottles—chroma: 2 to 6 moist or dry
- Texture—silty clay loam or silt loam
- Clay content— 25 to 32 percent

Btg horizon:
- Hue—10YR or 2.5Y
- Value—6 to 8 (4 to 6 moist)
- Mottles—distinct or prominent; value: 4 or 5 moist; chroma: 1 to 6 dry or moist
- Texture—silt loam or silty clay loam
- Clay content—25 to 32 percent

Cg horizons:
- Hue—10YR or 2.5Y
- Value—6 to 8 (4 to 6 moist)
- Chroma—1 or 2 dry or moist
- Mottles—value: 4 or 5 moist; chroma: 2 to 6 dry or moist
- Texture—silt loam or silty clay loam; gravelly or cobbly below 48 inches in some pedons

Daveggio Series

Depth class: Deep
Drainage class: Well drained
Landform: Mountain ridges
Parent material: Weathered material derived from micaceous schist with a thick mantle of volcanic ash
Slope range: 15 to 35 percent

Elevation: 4,800 to 5,500 feet
Average annual precipitation: 40 to 55 inches
Average annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Taxonomic Class: Medial over loamy, mixed Vitric Fulvicryands

Typical Pedon

Daveggio silt loam, in an area of Daveggio silt loam, 15 to 35 percent slopes, 2.5 miles east of Huckleberry Mountain, Shoshone County, 1,800 feet south and 500 feet east of the northwest corner of sec. 32, T. 45 N., R. 3 E.

Oi—1.75 to 1.0 inch; slightly decomposed needles, leaves, and twigs.
Oe—1.0 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and few medium roots; many very fine tubular pores; 5 percent pebbles; neutral (pH 6.8); clear wavy boundary.
Bw1—9 to 15 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; 5 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.
Bw2—15 to 21 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; 5 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.
2Bt1—21 to 29 inches; light yellowish brown (10YR 6/4) loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; few faint clay films on faces of peds and lining pores; many very fine and fine mica flakes; 10 percent pebbles; strongly acid (pH 5.5); abrupt wavy boundary.
2Bt2—29 to 41 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; few very fine and fine roots; many very fine and fine irregular pores; few faint clay films on faces of peds and lining pores; many very fine, fine, and common medium and coarse mica flakes; 10 percent pebbles; strongly acid (pH 5.5); clear wavy boundary.
2C—41 to 50 inches; very pale brown (10YR 7/4) gravelly sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots; many very fine and fine irregular pores; many very fine, fine, medium, and coarse mica flakes; 10 percent soft fragments of decomposed schist; 20 percent pebbles; very strongly acid (pH 5.0); clear wavy boundary.
2Cr—50 inches; highly weathered soft micaceous schist.

Range in Characteristics

Depth to bedrock: 40 to 60 inches
Umbric epipedon: 12 to 16 inches
Volcanic ash mantle: 18- to 22-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 80 to 100 percent

A horizon:
Base saturation—2 to 20 percent
Bulk density—0.65 to 0.85 g/cm^3

Bw horizons:
Chroma—3 or 4 dry or moist
Base saturation—2 to 20 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

2Bt horizons:
Texture—silt loam, loam, or gravelly loam
Pebble content—10 to 25 percent
Clay content—4 to 10 percent
Reaction—strongly acid to slightly acid

2C horizon:
Texture—gravelly or cobbly sandy loam
Rock fragment content—15 to 30 percent
Reaction—very strongly acid or strongly acid

Dorb Series

Depth class: Deep
Drainage class: Well drained
Landform: Canyonsides and escarpments
Parent material: Volcanic ash overlying basalt
Slope range: 35 to 65 percent
Elevation: 2,200 to 3,200 feet

Average annual precipitation: 30 to 35 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Ashy-skeletal, frigid Typic Udivitrands

Typical Pedon

Dorb stony silt loam, in an area of Dorb stony silt loam, 35 to 65 percent slopes, 4.5 miles southeast of St. Maries, Benewah County, 500 feet south and 100 feet west of the northeast corner of sec. 7, T. 45 N., R. 1 W.

Oi—2.5 to 1 inch; slightly decomposed needles, twigs, and moss.
Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 3 inches; yellowish brown (10YR 5/4) stony silt loam, dark yellowish brown (10YR 3/4) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine and few medium tubular pores; 10 percent pebbles, 5 percent cobbles, and 1 percent stones; about 0.1 percent stones on the surface; neutral (pH 6.8); clear wavy boundary.
Bw1—3 to 13 inches; light yellowish brown (10YR 6/4) cobbly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine, fine, and few medium tubular pores; 10 percent pebbles, 15 percent cobbles, and 1 percent stones; slightly acid (pH 6.5); clear wavy boundary.
Bw2—13 to 26 inches; light yellowish brown (10YR 6/4) very stony silt loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine and fine tubular pores; 10 percent pebbles, 20 percent cobbles, and 20 percent stones; slightly acid (pH 6.5); clear wavy boundary.
Bw3—26 to 34 inches; light yellowish brown (10YR 6/4) extremely stony silt loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; few very fine, fine, and medium roots; common very fine and few fine tubular pores; 25 percent pebbles, 20 percent cobbles, and 30 percent stones; slightly acid (pH 6.3); abrupt wavy boundary.
2C—34 to 50 inches; light yellowish brown (10YR 6/4) extremely stony loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; few very fine and fine roots; common very fine and few fine tubular pores; 20 percent pebbles, 30 percent cobbles, and 35 percent stones; slightly acid (pH 6.3); abrupt irregular boundary.
2R—50 inches; hard, fractured basalt bedrock.

Range in Characteristics

Depth to bedrock: 40 to 60 inches
Surface stones: 0.01 to 0.1 percent
Volcanic ash mantle: 20- to 40-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent
Reaction: slightly acid or neutral

A horizon:
Value—4 or 5 (2 or 3 moist)
Chroma—2 to 4 dry or moist
Rock fragment content—15 to 25 percent
Bulk density—0.65 to 0.85 g/cm^3

Bw horizons:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—3 or 4 dry or moist
Texture—cobbly, very cobbly, or very stony silt loam in the upper part, and extremely stony, extremely cobbly, or very stony silt loam in the lower part
Rock fragment content—25 to 45 percent in the upper part; 45 to 75 percent in the lower part
Bulk density—0.65 to 0.85 g/cm^3

2C horizon:
Chroma—3 or 4 dry and moist
Texture—extremely stony loam or extremely stony silt loam
Rock fragment content—75 to 90 percent

Flewsie Series

Depth class: Very deep
Drainage class: Well drained
Landform: Foothills and mountains
Parent material: Weathered material derived from fine-grained quartzite with a thick mantle of volcanic ash
Slope range: 15 to 65 percent
Description of complex slopes: Hilly to very steep
Elevation: 2,800 to 4,700 feet
Average annual precipitation: 40 to 50 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 70 to 90 days

Taxonomic Class: Ashy over loamy, mixed, frigid Typic Udivitrands

Typical Pedon

Flewsie silt loam, in an area of Flewsie silt loam, 35 to 65 percent slopes, 4.5 miles east of Clarkia, Shoshone County, 1,050 feet south and 2,200 feet east of the northwest corner of sec. 1, T. 42 N., R. 2 E.

Oi—3 to 2 inches; slightly decomposed needles, leaves, twigs, and bark.
Oe—2 inches to 0; decomposed organic matter.
A—0 to 4 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; neutral (pH 7.0); clear wavy boundary.
Bw1—4 to 15 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; few fine iron concretions; neutral (pH 7.0); abrupt wavy boundary.
2Bw2—15 to 24 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; few very fine, fine, medium, and coarse roots; many very fine irregular pores; slightly acid (pH 6.5); gradual wavy boundary.
2BC—24 to 37 inches; pale yellow (2.5Y 7/4) fine sandy loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; few very fine, fine, and medium roots; many very fine irregular pores; 5 percent fine pebbles; moderately acid (pH 5.8); gradual wavy boundary.
2C1—37 to 50 inches; light gray (2.5Y 7/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky, and plastic; few very fine, fine, and medium roots; many very fine irregular pores; 20 percent soft quartzite fragments; 5 percent fine pebbles; moderately acid (pH 5.8); gradual wavy boundary.
2C2—50 to 60 inches; light gray (2.5Y 7/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine and fine roots; many very fine and fine irregular pores; 40 percent soft quartzite fragments; common yellowish brown (10YR 5/4) moist and (10YR 5/6) moist iron stains on surface of soft fragments; 5 percent fine pebbles; moderately acid (pH 6.0).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 14- to 21-inches thick
Volcanic glass content: 20 to 50 percent
Phosphate retention: 55 to 90 percent

A horizon:
Value—5 or 6 (3 or 4 moist)
Chroma—3 or 4 dry or moist
Pebble content—0 to 5 percent
Bulk density—0.65 to 0.85 g/cm^3

Bw horizon:
Hue—10YR or 7.5YR
Chroma—3 to 6 dry or moist
Pebble content—0 to 5 percent
Bulk density—0.65 to 0.90 g/cm^3
Reaction—slightly acid or neutral

2Bw horizon:
Value—5, 6 or 7 (3, 4 or 5 moist)
Chroma—3 or 4 dry or moist
Texture—fine sandy loam, very fine sandy loam, loam, silt loam or loamy very fine sand; may be gravelly in some pedons
Pebble content—0 to 20 percent
Soft quartzite fragments—0 to 30 percent
Reaction—slightly acid or neutral

2C horizons:
Hue - 2.5Y or 10YR
Value—7 or 8 (5 to 7 moist)
Chroma—2 to 4 dry or moist
Texture—loamy fine sand, loamy very fine sand, fine sandy loam, or very fine sandy loam; some pedons are gravelly
Pebble content—0 to 20 percent
soft quartzite fragments - 10 to 50 percent
Reaction—strongly acid to slightly acid

Floodwood Series

Depth class: Very deep
Drainage class: Well drained
Landform: Foothills and mountains
Parent material: Weathered material derived from anorthosite, schist, and gneiss with a mantle of volcanic ash
Slope range: 15 to 65 percent
Description of complex slopes: Hilly to very steep
Elevation: 2,400 to 4,800 feet
Average annual precipitation: 55 to 65 inches

Average annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Fine-loamy, mixed Andic Glossoboralfs

Typical Pedon

Floodwood silt loam, in an area of Floodwood-Keeler, warm silt loams, 35 to 65 percent slopes, 17 miles east of Clarkia, Shoshone County, 2,200 feet north and 600 feet east of the southwest corner of sec. 25, T. 42 N., R. 4 E.

Oi—2 to 1 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter.
A—0 to 5 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky, and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; common fine, rounded iron and manganese concretions; neutral (pH 6.8); clear wavy boundary.
Bw—5 to 12 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and fine tubular pores; common fine, rounded iron and manganese concretions; neutral (pH 6.8); clear wavy boundary.
2Bt1—12 to 29 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist, moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and few fine and medium roots; common very fine and fine tubular pores; common faint clay films on faces of peds and lining pores; 5 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.
2Bt2—29 to 38 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, slightly sticky, and slightly plastic; common very fine and fine roots; common very fine and fine tubular and irregular pores; common faint clay films on faces of peds and few distinct clay films lining pores; wavy clayey band 0.5-inch thick in lower part of horizon; common medium iron stains; 10 percent pebbles; moderately acid (pH 5.6); clear wavy boundary.
2BC—38 to 42 inches; pale yellow (2.5Y 7/4) fine sandy loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable, nonsticky, slightly plastic; few very fine roots; many very fine and fine irregular pores; few faint clay films lining pores; 10 percent pebbles; moderately acid (pH 6.0); clear wavy boundary.
2C1—42 to 54 inches; light yellowish brown (2.5Y 6/4) gravelly loamy fine sand, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots; many very fine and fine irregular pores; three discontinuous yellow (10YR 7/6) clayey bands 0.5- to 1.25-inches thick in lower part of horizon; 10 percent pebbles and 5 percent cobbles; slightly acid (pH 6.5); clear wavy boundary.
2C2—54 to 60 inches; very pale brown (10YR 8/4) gravelly fine sandy loam, yellow (10YR 7/6) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots; many very fine irregular pores; 10 percent pebbles and 5 percent cobbles; moderately acid (pH 6.0).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 10- to 14-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Value—5 or 6 (3 or 4 moist)
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

Bw horizon:
Value—5 or 6 (3 or 4 moist)
Chroma—3 or 4 dry and moist
Pebble content—0 to 5 percent
Bulk density—0.65 to 0.85 g/cm^3

2Bt horizons:
Value—7 or 8 (5 or 6 moist)
Chroma—3 to 6, dry or moist
Texture—loam, silt loam, gravelly silt loam, or gravelly loam
Pebble content—0 to 20 percent
Cobble content—0 to 5 percent
Clay content—18 to 27 percent
Base saturation—35 to 50 percent

2C horizons:
Value—4 to 7 moist
Chroma—3 to 6 dry or moist
Texture—loamy fine sand, gravelly loamy fine sand, fine sandy loam, gravelly fine sandy loam, very fine sandy loam, or gravelly very fine sandy loam
Pebble content—5 to 20 percent

Cobble content—0 to 10 percent
Reaction—strongly acid to slightly acid;

Garveson Series

Depth class: Very deep
Drainage class: Well drained
Landform: Foothills and mountains
Parent material: Weathered material derived from granitic bedrock with a thick mantle of volcanic ash
Slope range: 15 to 65 percent
Description of complex slopes: Hilly to very steep
Elevation: 2,600 to 4,800 feet
Average annual precipitation: 30 to 65 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Ashy over sandy or sandy-skeletal, mixed, frigid Typic Udivitrands

Typical Pedon

Garveson silt loam, in an area of Jacot-Garveson silt loams, 15 to 35 percent slopes, 1.5 miles west of Pettis Peak, Benewah County, 500 feet south and 800 feet west of the northeast corner of sec. 22, T. 45 N., R. 1 W.

Oi—1.5 to 0.5 inch; undecomposed needles, bark, twigs, cones, and moss.
Oe—0.5 inch to 0; partially decomposed organic matter.
A—0 to 2 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, nonsticky, and slightly plastic; many very fine, and fine and few medium and coarse roots; common very fine and few fine tubular and irregular pores; 5 percent fine pebbles; neutral (pH 7.0); clear wavy boundary.
Bw1—2 to 7 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and few medium and coarse roots; common very fine and few fine tubular and irregular pores; 5 percent fine pebbles; neutral (pH 7.0); clear wavy boundary.
Bw2—7 to 16 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine, and few medium roots; common very fine and few fine tubular and irregular pores; 10 percent fine pebbles; neutral (pH 7.0); abrupt wavy boundary.
2BC—16 to 23 inches; pale brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, friable, nonsticky, and nonplastic; few very fine and fine roots; common very fine and few fine tubular and irregular pores; 40 percent fine pebbles; slightly acid (pH 6.5); clear wavy boundary.
2C1—23 to 30 inches; very pale brown (10YR 7/3) very gravelly loamy coarse sand; brown (10YR 5/3) moist; massive slightly hard, friable, nonsticky, and nonplastic; few very fine and fine roots; many very fine irregular pores; 40 percent fine pebbles; moderately acid (pH 6.0); gradual wavy boundary.
2C2—30 to 60 inches; variegated very gravelly coarse sand; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine and fine roots; many very fine irregular pores; 40 percent fine pebbles; moderately acid (pH 6.0).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 14- to 20-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Hue - 10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—3 or 4 dry or moist
Pebble content—fine, 0 to 10 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—moderately acid to neutral

Bw horizons:
Hue—10YR or 7.5YR
Chroma—4 to 6 dry or moist
Pebble content—fine, 0 to 10 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—moderately acid to neutral

2BC horizon:
Value—6 to 8 (4 to 6 moist)
Chroma—3 or 4 dry or moist
Texture—gravelly or very gravelly loamy sand or loamy coarse sand
Pebble content—15 to 40 percent
Reaction—moderately acid or slightly acid

2C horizons:
Hue—10YR, 2.5Y, or variegated
Value—7 or 8 (5 or 6 moist)
Chroma—3 to 6 dry or moist
Texture—gravelly or very gravelly loamy sand, loamy coarse sand, or coarse sand
Pebble content—25 to 40 percent

Cobble content—0 to 10 percent
Reaction—very strongly acid to moderately acid

Goatrock Series

Depth class: Very deep
Drainage class: Well drained
Landform: High elevation mountain slopes
Parent material: Weathered material derived from granite, gneiss, or schist bedrock with a thick mantle of volcanic ash
Slope range: 35 to 75 percent
Elevation: 5,000 to 6,300 feet
Average annual precipitation: 55 to 65 inches
Average annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Taxonomic Class: Medial-skeletal Vitric Fulvicryands

Typical Pedon

Goatrock, in an area of Goatrock-Rock outcrop complex, 35 to 75 percent slopes, 20 miles east of Clarkia, Shoshone County, 400 feet south and 1,100 feet west of the northeast corner of sec. 22, T. 42 N., R. 5 E.

Oi—.5 inch to 0; slightly decomposed grasses, leaves, and twigs.
A—0 to 8 inches; grayish brown (10YR 5/2) very stony silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky, and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; 20 percent pebbles, 20 percent cobbles, and 10 percent stones; about 3 percent stones on the surface; neutral (pH 6.6); gradual wavy boundary.
Bw1—8 to 17 inches; brown (10YR 5/3) very cobbly silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; 15 percent pebbles, 30 percent cobbles, and 10 percent stones; neutral (pH 6.8); clear wavy boundary.
Bw2—17 to 26 inches; yellowish brown (10YR 5/4) extremely cobbly silt loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; many very fine and fine tubular pores; 30 percent pebbles, 30 percent cobbles, and 10 percent stones; neutral (pH 6.8); clear wavy boundary.
2BC—26 to 36 inches; light yellowish brown (10YR 6/4) extremely gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; 40 percent pebbles, 15 percent cobbles, and 10 percent stones; slightly acid (pH 6.5); gradual wavy boundary.
2C1—36 to 46 inches; light yellowish brown (10YR 6/4) extremely gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; common very fine and fine roots; common very fine and fine tubular and irregular pores; 40 percent pebbles, 20 percent cobbles, and 10 percent stones; moderately acid (pH 5.8); gradual wavy boundary.
2C2—46 to 60 inches; very pale brown (10YR 7/4) extremely gravelly loamy sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine and fine roots; many very fine and fine irregular pores; 50 percent pebbles, 20 percent cobbles, and 10 percent stones; moderately acid (pH 6.0).

Range in Characteristics

Umbric epipedon: 14- to 18-inches thick
Depth to bedrock: More than 60 inches
Surface stones: 0.1 to 3 percent
Volcanic ash mantle: 25- to 30-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 80 to 100 percent

A horizon:
Chroma—2 or 3 dry or moist
Rock fragment content—35 to 55 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

Bw horizons:
Value—5 or 6 (3 or 4 moist)
Texture—very cobbly, extremely cobbly, very stony, or extremely stony silt loam
Rock fragment content—50 to 70 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

2C horizons:
Chroma—3 or 4 dry or moist
Texture—extremely gravelly, extremely cobbly, or extremely stony sandy loam or loamy sand
Rock fragment content—65 to 90 percent
Reaction—strongly acid to slightly acid

Helmer Series

Depth class: Shallow to a fragipan
Drainage class: Moderately well drained
Landform: Terraces, footslopes, and toeslopes
Parent material: Loess deposits overlying basalt or old alluvium with a thick mantle of volcanic ash
Slope range: 3 to 40 percent
Description of complex slopes: Undulating to hilly
Elevation: 2,140 to 3,800 feet
Average annual precipitation: 30 to 45 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 70 to 110 days

Taxonomic Class: Ashy, frigid Alfic Udivitrands

Typical Pedon

Helmer silt loam, in an area of Helmer-Sly silt loams, 3 to 25 percent slopes, 1.5 miles east of St. Maries, Benewah County, 1,800 feet south and 900 feet west of the northeast corner of sec. 24, T. 46 N., R. 2 W.

Oi—2 to 1 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter with Mt. St. Helens ash mixed in the upper part.
A—0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to weak very fine and fine granular; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine and few medium irregular pores; neutral (pH 7.0); clear wavy boundary.
Bw—3 to 15 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and fine and few medium irregular pores; neutral (pH 7.0); clear wavy boundary.
2Bw—15 to 18 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; hard, firm, slightly sticky, and slightly plastic; common very fine and fine and few medium roots; common very fine and fine and few medium tubular pores; neutral (pH 6.8); abrupt wavy boundary.
2Bx/E—18 to 30 inches; mixed pale brown (10YR 6/3) and very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) and (10YR 5/3) moist; few fine and medium distinct mottles that are dark yellowish brown (10YR 4/6) and grayish brown (10YR 5/2) when moist; weak very coarse prismatic structure parting to moderate medium and coarse angular blocky; very hard, very firm, slightly sticky, and slightly plastic; dense and somewhat brittle; common very fine and fine matted and flattened roots on peds; common very fine and fine tubular pores; few faint white (10YR 8/2) silt coatings, light gray (10YR 7/2) moist, on faces of peds; few fine manganese concretions; moderately acid (pH 5.8); clear wavy boundary.
2Btx/E—30 to 38 inches; mixed very pale brown (10YR 7/3) and light gray (10YR 7/2) silt loam, brown (10YR 5/3) and grayish brown (10YR 5/2) moist; common medium and large distinct mottles that are yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) when moist; weak very coarse prismatic structure parting to strong medium and coarse angular blocky; very hard, very firm, slightly sticky, and slightly plastic; dense and somewhat brittle; common very fine and fine matted and flattened roots on peds; common very fine and fine tubular pores; common faint clay films on faces of peds and lining pores; few fine manganese concretions; strongly acid (pH 5.5); abrupt wavy boundary.
2Btb1—38 to 45 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; few fine faint mottles that are brown (10YR 5/3) when moist; strong medium and coarse angular blocky structure; very hard, very firm, sticky, and slightly plastic; few very fine roots in peds and common very fine and fine roots between peds; common very fine and fine and few medium tubular pores; common faint clay films on faces of peds and common faint and few distinct clay films lining pores; few faint very pale brown (10YR 8/2) silt coatings, light gray (10YR 7/2) moist, on faces of peds; very strongly acid (pH 4.8); clear wavy boundary.
2Btb2—45 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; strong medium and coarse angular blocky structure; very hard, very firm, sticky, and slightly plastic; few very fine roots in peds and common very fine and fine roots between peds; few very fine, fine, and medium tubular pores; common faint and distinct, and few prominent clay films on faces of peds and lining pores; few very fine and fine manganese concretions; few faint very pale brown (10YR 8/2) silt coatings on faces of peds, light gray (10YR 7/2) moist; very strongly acid (pH 5.0).

Range in Characteristics

Depth to bedrock: More than 60 inches
Depth to fragipan: 14 to 20 inches

Depth to perched water table: 12 to 18 inches (February to April)
Volcanic ash mantle: 14- to 20-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Value—4 or 5 (2 or 3 moist)
Chroma—2 to 4 dry or moist
Bulk density—0.65 to 0.85 g/cm^3
Reaction—moderately acid to neutral

Bw horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Bulk density—0.65 to 0.85 g/cm^3
Reaction—moderately acid to neutral

2Bw horizon:
Chroma—3 or 4 dry or moist
Bulk density—1.40 to 1.60 g/cm^3
Reaction—moderately acid to neutral

2E horizon (present in some pedons):
Hue—10YR
Value—7 (5 moist)
Chroma—2 or 3 dry or moist
Texture—silt loam
Reaction—strongly acid to slightly acid

2Bx/E horizon:
Value—6 to 8 (4 to 6 moist)
Chroma—2 to 4 dry or moist
Mottles—chroma: 2 to 6 moist
Clay content—10 to 16 percent
Bulk density—1.70 to 1.80 g/cm^3
Reaction—strongly acid or moderately acid

2Btx/E horizon:
Value—6 to 8 (4 to 6 moist)
Chroma—2 to 4 dry or moist
Mottles—chroma: 2 to 6 moist
Clay content—14 to 22 percent
Bulk density—1.70 to 1.80 g/cm^3
Reaction—very strongly acid to moderately acid

2Btb horizons:
Hue—10YR or 7.5YR
Value—5 to 7 dry (3 to 5 moist)
Chroma—3 or 4 dry or moist
Texture—silt loam, silty clay loam; some pedons are cobbly and gravelly in lower part
Rock fragment content—0 to 30 percent;
Clay content—22 to 30 percent
Bulk density—1.50 to 1.75 g/cm^3;
Reaction—very strongly acid to moderately acid

Note: In map unit 37, Helmer soils have very strongly acid or extremely acid surface horizons and have lost a portion of the volcanic ash mantle due to erosion.

Hobo Series

Depth class: Very deep
Drainage class: Moderately well drained
Landform: Dissected terraces and foothills
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a thick mantle of volcanic ash (fig. 19)
Slope range: 5 to 35 percent
Description of complex slopes: Rolling to hilly
Elevation: 2,140 to 4,000 feet
Average annual precipitation: 30 to 45 inches
Average annual air temperature: 42 to 46 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Ashy over loamy, mixed, frigid Alfic Udivitrands

Typical Pedon

Hobo silt loam, in an area of Hobo silt loam, 15 to 35 percent slopes, Benewah County, Idaho, 4 miles west of Emida, 500 feet south and 1,115 feet west of the northeast corner of sec. 34, T. 44 N., R. 3 W.

Oi—1.5 to 0.5 inch; slightly decomposed needles, leaves, twigs, and moss.
Oe—0.5 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and common medium roots; many very fine and fine and few medium tubular pores; slightly acid (pH 6.5); clear wavy boundary.
Bw1—2 to 7 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine and fine and few medium tubular pores; slightly acid (pH 6.5); gradual wavy boundary.
Bw2—7 to 15 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist;

Figure 19.—Profile of Hobo silt loam. It has a volcanic ash mantle about 15-inches thick over a very firm silt loam and gravelly silty clay loam subsoil.

weak medium and coarse subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine and fine and few medium tubular pores; neutral (pH 6.7); abrupt wavy boundary.

2E—15 to 22 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; few very fine and fine roots; common very fine and few fine tubular pores; common faint silt coats on faces of peds; 5 percent pebbles; slightly acid (pH 6.5); gradual wavy boundary.

2Bt/E—22 to 32 inches; mixed light brown (7.5YR 6/4) and very pale brown (10YR 7/3) silt loam, brown (7.5YR 4/4) and (10YR 5/3) moist; weak coarse prismatic structure parting to moderate medium and coarse angular blocky structure; very hard, very firm, slightly sticky, and slightly plastic; few very fine and fine roots; common very fine and few fine tubular pores; common faint and distinct clay films on faces of peds and lining pores; 15 percent E material between peds; 10 percent

pebbles; moderately acid (pH 6.0); gradual wavy boundary.
2Bt1—32 to 45 inches; light brown (7.5YR 6/4) gravelly silty clay loam, brown (7.5YR 4/4) moist; moderate coarse angular blocky structure; very hard, very firm, sticky, and plastic; few very fine roots; common very fine and few fine tubular pores; many distinct clay films on faces of peds and lining pores; common medium manganese stains; common faint silt coatings on faces of peds; 15 percent pebbles and 5 percent cobbles; strongly acid (pH 5.5); clear wavy boundary.
2Bt2—45 to 60 inches; reddish yellow (7.5YR 6/6) very gravelly clay loam, strong brown (7.5YR 4/6) moist; weak medium and coarse subangular blocky structure; very hard, very firm, sticky, and plastic; common very fine and few fine tubular pores; common distinct clay films on faces of peds and lining pores; few fine manganese stains; common faint silt coatings on faces of peds; 25 percent pebbles and 20 percent cobbles; very strongly acid (pH 5.0).

Range in Characteristics

Depth to perched water table: 12 to 24 inches (February to April)
Volcanic ash mantle: 14- to 20-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Hue—10YR or 7.5YR
Value—3 to 6 (2 to 4 moist)
Chroma—2 to 4 dry or moist
Pebble content—0 to 10 percent
Bulk density—0.65 to 0.90 g/cm^3
Reaction—moderately acid to neutral

Bw horizons:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—3 to 6 dry or moist
Pebble content—0 to 10 percent
Cobble content—0 to 5 percent
Bulk density—0.65 to 0.90 g/cm^3
Reaction—moderately acid to neutral

2E horizon:
Hue—10YR, 7.5YR, or 5YR
Value—6 to 8 (4 to 6 moist)
Chroma—3 to 6 dry or moist
Texture—silt loam or loam; gravelly or cobbly in some pedons
Pebble content—0 to 20 percent
Cobble content—0 to 10 percent
Reaction—moderately acid to neutral

2Bt/E horizon: (absent in some pedons)
Hue—10YR, 7.5YR, or 5YR
Value—6 to 8 (4 to 6 moist)
Chroma—3 to 6 dry and moist
Texture—silt loam, silty clay loam, or loam; may be gravelly or cobbly
Pebble content—0 to 20 percent
Cobble content—0 to 10 percent
Clay content—18 to 30 percent
Base saturation—35 to 75 percent
Reaction—very strongly acid to moderately acid

2Bt horizons:
Hue—7.5YR, 5YR, or 10YR
Value—6 to 8 (4 to 6 moist)
Chroma—3 to 6 dry or moist
Texture—silt loam, loam, sandy clay loam, clay loam, or silty clay loam; may be gravelly or cobbly in the upper part, and gravelly, very gravelly, very cobbly, extremely cobbly, or extremely stony in the lower part
Rock fragment content—5 to 25 percent in the upper part; 30 to 60 percent in the lower part
Clay content—18 to 34 percent
Base saturation—35 to 75 percent
Reaction—very strongly acid to moderately acid

2BC horizon: (present in some pedons)
Hue—5YR, 7.5YR, or 10YR
Value—7 or 8 (5 or 6 moist)
Chroma—3 to 8 dry and moist
Texture—gravelly loam, very gravelly silt loam, or very gravelly sandy loam
Pebble content—15 to 35 percent
Cobble content—5 to 15 percent
Soft fragments of decomposed rock—15 to 35 percent
Reaction—moderately acid or slightly acid

Note: In map units 34, 35, and 37, Hobo soils have strongly acid to extremely acid surface horizons, and, in eroded areas, have lost a portion of the volcanic ash mantle.

Honeyjones Series

Depth class: Very deep
Drainage class: Well drained
Landform: Mountains and breaklands
Parent material: Weathered material derived from metasedimentary bedrock, mainly siltite and argillite with a thick mantle of volcanic ash
Slope range: 15 to 85 percent
Elevation: 2,200 to 4,800 feet
Average annual precipitation: 30 to 45 inches

Average annual air temperature: 41 to 45 degrees F
Frost-free period: 60 to 90 days

Taxonomic Class: Ashy over loamy-skeletal, mixed, frigid Typic Udivitrands

Typical Pedon

Honeyjones, in an area of Honeyjones-Ahrs association, 35 to 75 percent slopes, 1 mile southwest of St. Joe Baldy, Benewah County, 950 feet north and 400 feet west of the southeast corner of sec. 3, T. 46 N., R. 1 W.

Oi—1.5 to 0.5 inch; slightly decomposed needles, leaves, and twigs.
Oe—0.5 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine and fine and few medium tubular pores; 10 percent pebbles; neutral (pH 7.0); clear wavy boundary.
Bw1—2 to 8 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine and common fine tubular pores; 10 percent pebbles; neutral (pH 7.0); gradual wavy boundary.
Bw2—8 to 15 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine and common fine tubular pores; 15 percent pebbles; neutral (pH 7.0); abrupt wavy boundary.
2Bw3—15 to 24 inches; very pale brown (10YR 7/3) extremely cobbly loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and common fine tubular pores; 25 percent pebbles, 30 percent cobbles, and 10 percent stones; slightly acid (pH 6.5); clear wavy boundary.
2Bw4—24 to 42 inches; very pale brown (10YR 7/3) extremely stony loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and common fine tubular pores; 25 percent pebbles, 25 percent cobbles, and 30 percent stones; slightly acid (pH 6.2); clear wavy boundary.
2C—42 to 62 inches; very pale brown (10YR 7/3) extremely stony loam, brown (10YR 5/3) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; few very fine and fine and medium roots; common very fine and fine tubular and irregular pores; 25 percent pebbles, 20 percent cobbles, and 40 percent stones; slightly acid (pH 6.2).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 14- to 24-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—2 to 4 dry or moist
Texture—silt loam or gravelly silt loam
Pebble content—5 to 30 percent
Bulk density—0.65 to 0.90 g/cm^3
Reaction—moderately acid to neutral

Bw horizons:
Hue—10YR or 7.5YR
Value—5 to 7 (3 to 5 moist)
Chroma—4 or 6 dry or moist
Texture—silt loam or gravelly silt loam
Rock fragment content—5 to 30 percent
Bulk density—0.65 to 0.90 g/cm^3
Reaction—moderately acid to neutral

2Bw horizons:
Hue—10YR or 7.5YR
Value—6 or 7
Chroma—3 to 6 dry or moist
Texture—very gravelly, extremely gravelly, very cobbly, extremely cobbly, very stony or extremely stony silt loam or loam
Rock fragment content—45 to 85 percent
Reaction—moderately acid to neutral

2C horizon:
Hue—10YR or 7.5YR
Value—6 to 8 (4 to 6 moist)
Chroma—3 to 6 dry or moist
Texture—extremely gravelly, extremely cobbly, extremely stony, or extremely flaggy silt loam or loam
Rock fragment content—65 to 90 percent
Reaction—moderately acid or slightly acid

Hugus Series

Depth class: Very deep
Drainage class: Well drained
Landform: Foothills and dissected terraces
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Slope range: 30 to 65 percent
Elevation: 2,160 to 4,700 feet
Average annual precipitation: 30 to 50 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Ashy over loamy-skeletal, mixed, frigid Alfic Udivitrands

Typical Pedon

Hugus silt loam, in an area of Hugus silt loam, 30 to 65 percent slopes, 0.75 mile northwest of Hoyt, Shoshone County, 2,500 feet south and 1,500 feet east of the northwest corner of sec. 11, T. 45 N., R. 4 E.

Oi—2 to 1.5 inches; slightly decomposed needles, leaves, and twigs.
Oe—1.5 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 4 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak fine subangular blocky structure parting to moderate fine granular; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and common medium roots; many very fine tubular pores; 5 percent pebbles; neutral (pH 6.8); clear wavy boundary.
Bw—4 to 15 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, medium, and few coarse roots; many very fine tubular pores; 10 percent pebbles; neutral (pH 6.8); abrupt wavy boundary.
2Bt1—15 to 20 inches; pale brown (10YR 6/3) very gravelly silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine tubular pores; few faint clay films on faces of peds and lining pores; 35 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.
2Bt2—20 to 30 inches; pale brown (10YR 6/3) very gravelly silt loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky, and slightly plastic; common very fine and fine and few medium roots; many very fine and fine and common medium tubular pores; many faint and common distinct clay films on faces of peds and lining pores; few faint silt coats on faces of peds; 35 percent pebbles and 5 percent cobbles; strongly acid (pH 5.5); clear wavy boundary.
2Bt3—30 to 41 inches; very pale brown (10YR 7/4) very gravelly silt loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few very fine, fine, and medium roots; common very fine and fine and few medium tubular pores; common faint and few distinct clay films on faces of peds and lining pores; 35 percent pebbles and 20 percent cobbles; strongly acid (pH 5.5); gradual wavy boundary.
2Bt4—41 to 52 inches; yellow (10YR 7/6) very gravelly silt loam, yellowish brown (10YR 5/6) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few very fine and fine roots; common very fine tubular pores; common faint clay films on faces of peds and lining pores; 45 percent pebbles and 5 percent cobbles; strongly acid (pH 5.2); gradual wavy boundary.
2Bt5—52 to 60 inches; yellow (10YR 8/6) extremely gravelly silt loam, brownish yellow (10YR 6/6) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few very fine and fine roots; common very fine tubular pores; few faint clay films on faces of peds and lining pores; few fine strong brown (7.5YR 5/8) iron stains; 60 percent pebbles and 5 percent cobbles; strongly acid (pH 5.2).

Range in Characteristics

Volcanic ash mantle: 14- to 20-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—2 to 4 dry or moist
Texture—silt loam, gravelly silt loam, cobbly silt loam, or gravelly loam
Rock fragment content—0 to 20 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—moderately acid to neutral

Bw horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)

Texture—silt loam, gravelly silt loam, or cobbly silt loam
Rock fragment content—0 to 25 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

2Bt horizons:
Hue—10YR, 7.5YR, or 5YR
Texture—very gravelly, very cobbly, extremely gravelly, extremely cobbly, or extremely stony silt loam, loam, or silty clay loam
Rock fragment content—35 to 75 percent
Clay content—18 to 28 percent in the upper part; 14 to 18 percent in the lower part
Base saturation—35 to 50 percent
Reaction—strongly acid to slightly acid

Note: In map units 45 and 49, Hugus soils have very strongly acid or extremely acid surface and subsoil horizons, and, in severely eroded areas, have lost a portion of the volcanic ash mantle.

Jacot Series

Depth class: Very deep
Drainage class: Well drained
Landform: Foothills
Parent material: Weathered material derived from gneiss or granitic bedrock with a thick mantle of volcanic ash
Slope range: 15 to 65 percent
Description of complex slopes: Hilly to very steep
Elevation: 2,200 to 4,400 feet
Average annual precipitation: 30 to 45 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 70 to 110 days

Taxonomic Class: Ashy over loamy, mixed, frigid Alfic Udivitrands

Typical Pedon

Jacot silt loam, in an area of Jacot silt loam, 35 to 65 percent slopes, 2.0 miles west of Marble Creek, Shoshone County, 2,000 feet north and 1,500 feet east of the southwest corner of sec. 10, T. 45 N., R. 3 E.

Oi—1.5 to 1 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 4 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak fine subangular blocky structure parting to moderate fine granular; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine tubular pores; 10 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.
Bw—4 to 14 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine, common fine and medium, and few coarse roots; common very fine and fine tubular pores; 10 percent pebbles; neutral (pH 6.8); abrupt wavy boundary.
2Bt1—14 to 20 inches; very pale brown (10YR 7/4) gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, and medium roots; common very fine tubular and many very fine and fine irregular pores; few faint clay films on faces of peds and lining pores; 20 percent pebbles; strongly acid (pH 5.5); clear wavy boundary.
2Bt2—20 to 40 inches; pale yellow (2.5Y 7/4) gravelly sandy loam, light olive brown (2.5Y 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; few very fine, fine, and medium roots; many very fine and fine irregular pores; few faint clay films on faces of peds and lining pores; 25 percent pebbles; strongly acid (pH 5.5); clear wavy boundary.
2C1—40 to 48 inches; pale yellow (2.5Y 8/4) gravelly loamy sand, light yellowish brown (2.5Y 6/4) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots; many very fine and fine irregular pores; 30 percent pebbles; moderately acid (pH 5.7); gradual wavy boundary.
2C2—48 to 60 inches; pale yellow (2.5Y 8/4) very gravelly loamy sand, light yellowish brown (2.5Y 6/4) moist; massive; loose, nonsticky, and nonplastic; few very fine roots; many very fine and fine irregular pores; 45 percent pebbles; moderately acid (pH 5.7).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 14- to 18-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Value—5 or 6 (3 or 4 moist)
Chroma—3 or 4 dry or moist
Pebble content—0 to 15 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

Bw horizon:
Chroma—3 or 4 dry or moist
Texture—silt loam or gravelly silt loam
Pebble content—5 to 20 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

2Bt horizons:
Value—6 to 8 (4 to 6 moist)
Chroma—3 to 6 dry or moist
Texture—loam, sandy loam, gravelly loam, or gravelly sandy loam
Pebble content—10 to 25 percent
Cobble content—0 to 5 percent
Reaction—strongly acid to slightly acid

2C horizons:
Hue—10YR or 2.5Y
Value—7 or 8 (5 or 6 moist)
Chroma—3 to 6 dry or moist
Texture—gravelly or very gravelly coarse sand, loamy sand, or loamy coarse sand
Pebble content—30 to 50 percent
Cobble content—0 to 5 percent
Reaction—strongly acid to slightly acid

Joebaldy Series

Depth class: Moderately deep to angular rock fragments
Drainage class: Well drained
Landform: High elevation mountain ridges
Parent material: Talus and colluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Slope range: 10 to 50 percent
Elevation: 5,200 to 6,300 feet
Average annual precipitation: 45 to 55 inches
Average annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Taxonomic Class: Medial-skeletal over fragmental Vitric Fulvicryands

Typical Pedon

Joebaldy, in an area of Joebaldy-Rubble land association, 10 to 50 percent slopes, 0.75 mile south of Rochat Peak, Benewah County, 2,300 feet north and 1,800 feet east of the southwest corner of sec. 25, T. 47 N., R. 1 W.

Oi—0.5 inch to 0; slightly decomposed needles, leaves, and twigs mixed with Mt. St. Helens volcanic ash.

A1—0 to 3 inches; dark gray (10YR 4/1) stony silt loam, black (10YR 2/1) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and few medium roots; many very fine and fine tubular and irregular pores; 10 percent pebbles, 10 percent cobbles, and 5 percent stones; about 0.1 percent stones on the surface; strongly acid (pH 5.5); clear wavy boundary.

A2—3 to 10 inches; dark grayish brown (10YR 4/2) stony silt loam, very dark brown (10YR 2/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and few medium roots; many very fine and fine tubular and irregular pores; 10 percent pebbles, 5 percent cobbles, and 10 percent stones; strongly acid (pH 5.5); clear wavy boundary.

Bw1—10 to 17 inches; brown (10YR 5/3) very stony silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine and few medium roots; common very fine and fine tubular and irregular pores; 15 percent pebbles, 10 percent cobbles, and 15 percent stones; moderately acid (pH 5.8); clear wavy boundary.

Bw2—17 to 28 inches; light yellowish brown (10YR 6/4) very stony silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine roots; common very fine and fine tubular and irregular pores; 20 percent pebbles, 15 percent cobbles, and 20 percent stones; moderately acid (pH 6.0); abrupt wavy boundary.

2C—28 to 60 inches; 25 percent pebbles, 35 percent cobbles, and 40 percent stones with no fines in the voids.

Range in Characteristics

Depth to angular rock fragments: 20 to 36 inches
Umbric epipedon: 12 to 20 inches
Surface stones: 0.01 to 0.1 percent
Volcanic ash mantle: 20- to 36-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 80 to 100 percent

A horizons:
Value—4 or 5 (2 or 3 moist)
Rock fragment content—15 to 30 percent
Base saturation—2 to 20 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—strongly acid or moderately acid

Bw horizons:
Chroma—3 or 4 dry or moist
Texture—very cobbly, very stony, extremely cobbly, or extremely stony silt loam or loam
Rock fragment content—40 to 80 percent
Base saturation—2 to 20 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—moderately acid or slightly acid

Keeler Series

Depth class: Very deep
Drainage class: Well drained
Landform: Foothills and mountains
Parent material: Weathered material derived from granite with a mantle of loess and minor amounts of volcanic ash
Slope range: 15 to 65 percent
Description of complex slopes: Hilly to very steep
Elevation: 2,600 to 4,600 feet
Average annual precipitation: 40 to 65 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 70 to 110 days

Taxonomic Class: Fine-loamy, mixed Vitrandic Glossoboralfs

Typical Pedon

Keeler silt loam, in an area of Keeler-Jacot silt loams, 30 to 55 percent slopes, 3.5 miles southwest of Clarkia, Shoshone County, 2,550 feet north and 1,050 feet east of the southwest corner of sec. 22, T. 42 N., R. 1 E.

Oi—2 to 1 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter.
A—0 to 5 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular and irregular pores; neutral (pH 7.0); clear wavy boundary.
BA—5 to 16 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and fine tubular and irregular pores; neutral (pH 6.8); clear wavy boundary.
Bt1—16 to 27 inches; very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, firm, sticky, and slightly plastic; common very fine and fine and few medium roots; common very fine and fine tubular pores; many faint and few distinct clay films on faces of peds and lining pores; slightly acid (pH 6.3); gradual wavy boundary.
Bt2—27 to 36 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky, and slightly plastic; few very fine and fine roots; common very fine and fine tubular pores; many faint, common distinct, and few prominent clay films on faces of peds and lining pores; slightly acid (pH 6.3); clear wavy boundary.
2Bt3—36 to 48 inches; mixed very pale brown (10YR 7/4) and reddish yellow (7.5YR 7/6) sandy loam, yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) moist; moderate medium and coarse subangular blocky structure; hard, firm, slightly sticky, and slightly plastic; few very fine roots; many very fine and fine tubular pores; many faint, common distinct, and few prominent clay films on faces of peds and lining pores; 5 percent fine pebbles; moderately acid (pH 6.0); gradual wavy boundary.
2Bt4—48 to 60 inches; reddish yellow (7.5YR 7/6) sandy clay loam, strong brown (7.5YR 5/6) moist; moderate coarse subangular blocky structure; hard, firm, sticky, and plastic; few very fine roots; many fine tubular pores; common distinct clay films on faces of peds and lining pores and few prominent clay films lining pores; 10 percent fine pebbles; moderately acid (pH 6.0).

Range in Characteristics

Depth to bedrock: More than 60 inches

A horizon:
Value—5 or 6 (3 or 4 moist)
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent

BA horizon:
Chroma—3 or 4 moist
Clay content—14 to 17 percent
Reaction—slightly acid or neutral

Bt horizons: (absent in some pedons)
Value—6 or 7 (4 or 5 moist)
Texture—loam, silt loam, or silty clay loam
Pebble content—fine, 0 to 10 percent
Clay content—20 to 30 percent

Base saturation—35 to 50 percent
Reaction—moderately acid or slightly acid

2Bt horizons:
Chroma—4 to 6 dry or moist
Texture—sandy loam, sandy clay loam, or clay loam, and may be fine gravelly in some pedons
Pebble content—fine, 5 to 30 percent
Clay content—18 to 34 percent
Base saturation—35 to 50 percent
Reaction—moderately acid or slightly acid

2C horizon: (present in some pedons)
Hue—10YR or 2.5Y
Value—7 or 8 (5 or 6 moist)
Chroma—3 to 6 dry or moist
Texture—gravelly or very gravelly sandy loam or coarse sandy loam
Pebble content—20 to 40 percent
Cobble content—0 to 5 percent;
Reaction—moderately acid or slightly acid

Kruse Series

Depth class: Very deep
Drainage class: Well drained
Landform: Foothills and mountains
Parent material: Weathered material derived from granite, gneiss, and schist with a mantle of loess and minor amounts of volcanic ash
Slope range: 35 to 65 percent
Elevation: 2,400 to 3,400 feet
Average annual precipitation: 28 to 35 inches
Average annual air temperature: 43 to 45 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Fine-loamy, mixed, frigid Vitrandic Haploxeralfs

Typical Pedon

Kruse fine gravelly silt loam, in an area of Kruse fine gravelly silt loam, 35 to 65 percent slopes, 2 miles northwest of Marble Creek, Shoshone County, 880 feet north and 2,400 feet east of the southwest corner of sec. 3, T. 45 N., R. 3 E.

Oi—1.5 to 0.75 inch; slightly decomposed needles, leaves, and twigs.
Oe—0.75 inch to 0; decomposed organic matter.
A—0 to 4 inches; brown (10YR 5/3) fine gravelly silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and fine, common medium, and few coarse roots; many very fine tubular pores; 15 percent fine pebbles; neutral (pH 6.8); gradual wavy boundary.
BA—4 to 15 inches; pale brown (10YR 6/3) fine gravelly silt loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine and fine tubular pores; few faint clay films in pores; 15 percent fine pebbles; slightly acid (pH 6.5); gradual wavy boundary.
Bt1—15 to 31 inches; very pale brown (10YR 7/4) fine gravelly loam, yellowish brown (10YR 5/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky, and slightly plastic; few very fine, fine, and medium roots; many very fine and fine tubular pores; many faint and few distinct clay films on faces of peds and lining pores; 25 percent fine pebbles; slightly acid (pH 6.2); clear wavy boundary.
Bt2—31 to 52 inches; yellow (10YR 7/6) fine gravelly sandy clay loam, yellowish brown (10YR 5/6) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky, and slightly plastic; few very fine roots; few very fine tubular and common fine irregular pores; many faint clay films on faces of peds and common distinct clay films lining pores; 25 percent fine pebbles; moderately acid (pH 6.0); gradual wavy boundary.
BC—52 to 60 inches; yellow (10YR 7/6) fine gravelly sandy loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, fine, and medium irregular pores; few faint clay films lining pores; 30 percent fine pebbles; moderately acid (pH 5.8).

Range in Characteristics

Depth to bedrock: More than 60 inches

A horizon:
Value—4 to 6 (2 to 4 moist)
Chroma—2 to 4 dry or moist
Pebble content—fine, 15 to 20 percent
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent

Bt horizons:
Hue—10YR or 7.5YR
Value—6 or 7 (4 or 5 moist)
Chroma—3 to 6 dry or moist
Pebble content—fine, 15 to 25 percent
Clay content—18 to 30 percent
Base saturation—50 to 75 percent
Reaction—moderately acid or slightly acid

BC horizon:
Value—6 or 7 (4 or 5 moist)
Chroma—3 to 6 dry or moist
Texture—fine gravelly loam or fine gravelly sandy loam
Pebble content—fine, 15 to 30 percent

Lacy Series

Depth class: Shallow
Drainage class: Well drained
Landform: Canyonsides and escarpments
Parent material: Weathered material derived from basalt with a mantle of loess
Slope range: 35 to 65 percent
Elevation: 2,125 to 3,200 feet
Average annual precipitation: 28 to 32 inches
Average annual air temperature: 47 to 50 degrees F
Frost-free period: 100 to 140 days

Taxonomic Class: Loamy-skeletal, mixed, mesic Lithic Ultic Argixerolls

Typical Pedon

Lacy stony loam, in an area of Lacy-Bobbitt stony loams, 35 to 65 percent slopes, 2 miles southeast of St. Maries, Benewah County, 2,400 feet north and 450 feet west of the southeast corner of sec. 25, T. 46 N., R. 2 W.

Oi—0.25 inch to 0; grass and leaves mixed with Mt. St. Helens volcanic ash.
A1—0 to 3 inches; brown (7.5YR 4/2) stony loam, dark brown (7.5YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and fine and few medium roots; many very fine and fine and few medium tubular pores; 5 percent pebbles, 5 percent cobbles, and 5 percent stones; 0.1 percent stones on the surface; neutral (pH 7.0); clear wavy boundary.
A2—3 to 11 inches; brown (7.5YR 4/2) stony loam, dark brown (7.5YR 3/2) moist; weak fine and medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, common fine, and few medium roots; many very fine and fine and few medium tubular pores; 10 percent pebbles, 5 percent cobbles, and 10 percent stones; neutral (pH 7.0); clear wavy boundary.
Bt—11 to 18 inches; brown (7.5YR 4/4) very cobbly clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky, and plastic; common very fine and few fine and medium roots; many very fine and fine and few medium tubular pores; few faint clay films on faces of peds and lining pores; 15 percent pebbles, 25 percent cobbles, and 5 percent stones; neutral (pH 7.0); abrupt irregular boundary.
R—18 inches; hard, fractured basalt.

Range in Characteristics

Depth to bedrock: 10 to 20 inches
Mollic epipedon: 7 to 18 inches
Base saturation: 50 to 75 percent
Surface stones: 0.01 to 0.1 percent

A horizons:
Hue—10YR or 7.5YR
Value—4 or 5 dry
Chroma—2 or 3 dry or moist
Rock fragment content—10 to 30 percent
Reaction—slightly acid or neutral

Bt horizon:
Hue—10YR, 7.5YR, or 5YR
Value—4 or 5 dry
Chroma—3 or 4 dry or moist
Texture—very cobbly, very stony, extremely cobbly, or extremely stony clay loam or loam
Rock fragment content—45 to 80 percent
Clay content—20 to 34 percent
Reaction—slightly acid or neutral

Latour Series

Depth class: Very deep
Drainage class: Well drained
Landform: Mountains and ridges
Parent material: Talus and colluvium derived from metasedimentary rocks with a thick mantle of volcanic ash
Slope range: 15 to 75 percent
Elevation: 4,800 to 6,200 feet
Average annual precipitation: 40 to 55 inches
Average annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Taxonomic Class: Medial-skeletal Vitric Haplocryands

Typical Pedon

Latour gravelly silt loam, in an area of Latour gravelly silt loam, 35 to 75 percent slopes, 0.75 mile northeast of St. Joe Baldy, Benewah County, 300 feet north and 2,300 feet west of the southeast corner of sec. 36, T. 47 N., R. 1 W.

Oi—2 to 1 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter.
A—0 to 2 inches; grayish brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and fine and few medium tubular and irregular pores; 10 percent pebbles, 5 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.
Bw1—2 to 11 inches; yellowish brown (10YR 5/4) gravelly silt loam, dark yellowish brown (10YR 3/4) moist; weak medium and coarse subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine and few medium and coarse roots; common very fine and fine and few medium tubular and irregular pores; 10 percent pebbles, 5 percent cobbles; slightly acid (pH 6.5); gradual wavy boundary.
Bw2—11 to 18 inches; light yellowish brown (10YR 6/4) very gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and few fine and medium roots; common very fine and fine and few medium tubular and irregular pores; 25 percent pebbles and 10 percent cobbles; slightly acid (pH 6.5); gradual wavy boundary.
Bw3—18 to 42 inches; light yellowish brown (10YR 6/4) extremely cobbly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and few fine, medium, and coarse roots; common very fine and fine and few medium tubular and irregular pores; 30 percent pebbles, 30 percent cobbles, and 10 percent stones; slightly acid (pH 6.5); abrupt wavy boundary.
2C—42 to 60 inches; light yellowish brown (10YR 6/4) extremely cobbly loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; few very fine roots; few very fine irregular pores; 30 percent pebbles, 40 percent cobbles, and 15 percent stones; slightly acid (pH 6.5).

Range in Characteristics

Depth to bedrock: More than 60 inches
Reaction: Moderately acid or slightly acid
Volcanic ash mantle: 20- to 42-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 80 to 100 percent

A horizon:
Hue—10YR or 7.5YR
Chroma—2, 3, or 4 dry or moist
Rock fragment content—15 to 30 percent
Bulk density—0.65 to 0.85 g/cm^3

Bw horizons:
Chroma—3 or 4 moist
Texture—gravelly, very gravelly, very cobbly, extremely cobbly, or extremely gravelly silt loam
Rock fragment content—15 to 35 percent in the upper part; 35 to 70 percent in the lower part
Bulk density—0.65 to 0.85 g/cm^3

2C horizon:
Value—6 or 7 (4 or 5 moist)
Texture—extremely gravelly, extremely cobbly, very cobbly, or extremely stony silt loam or loam
Rock fragment content—55 to 85 percent

Lotuspoint Series

Depth class: Moderately deep
Drainage class: Well drained
Landform: Breaklands, mountains, and canyonsides
Parent material: Weathered material derived from metasedimentary bedrock with a mixture of volcanic ash and loess
Slope range: 35 to 75 percent
Elevation: 2,160 to 4,000 feet
Average annual precipitation: 28 to 35 inches
Average annual air temperature: 47 to 49 degrees F
Frost-free period: 100 to 140 days

Taxonomic Class: Loamy-skeletal, mixed, mesic Andic Xerochrepts

Typical Pedon

Lotuspoint, in an area of Lotuspoint-Rock outcrop complex, 35 to 75 percent slopes, 1.1 miles southwest of St. Joe Baldy, Benewah County, 2,550 feet north and 1,800 feet west of the southeast corner of sec. 11, T. 46 N., R. 1 W.

Oi—0.75 inch to 0; slightly decomposed needles, leaves, and twigs, mixed with Mt. St. Helens volcanic ash.
A1—0 to 4 inches; dark grayish brown (10YR 4/2) stony silt loam, very dark brown (10YR 2/2) moist; weak very fine and fine granular structure; soft, very friable, nonsticky, and slightly plastic; many

very fine and fine and few medium and coarse roots; many very fine and fine and few medium tubular and irregular pores; 15 percent pebbles, 10 percent cobbles, and 5 percent stones; about 0.1 percent stones on the surface; neutral (pH 6.8); gradual wavy boundary.

A2—4 to 9 inches; dark grayish brown (10YR 4/2) very cobbly silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine and few medium tubular and irregular pores; 20 percent pebbles, 25 percent cobbles, and 10 percent stones; neutral (pH 6.8); clear wavy boundary.

Bt1—9 to 17 inches; yellowish brown (10YR 5/4) extremely cobbly silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine and fine and few medium and coarse roots; common very fine and fine tubular pores; few faint clay films lining pores; 25 percent pebbles, 30 percent cobbles, and 15 percent stones; neutral (pH 6.8); clear wavy boundary.

Bt2—17 to 30 inches; light yellowish brown (10YR 6/4) extremely cobbly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine and fine and few medium and coarse roots; common very fine and fine tubular pores; few faint clay films lining pores; 30 percent pebbles, 30 percent cobbles, and 20 percent stones; slightly acid (pH 6.5); abrupt wavy boundary.

2R—30 inches; hard, slightly fractured metasedimentary bedrock.

Range in Characteristics

Depth to bedrock: 20 to 40 inches
Volcanic ash mantle: 7- to 12-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent
Base saturation: 35 to 50 percent
Surface stones: 0.01 to 0.1 percent

A horizons:
Hue—10YR or 7.5YR
Value—4 or 5 (2 or 3 moist)
Chroma—2 through 4 dry or moist
Texture—stony silt loam or very cobbly silt loam
Rock fragment content—15 to 40 percent in the upper part; 35 to 60 percent in the lower part
Bulk density—0.65 to 0.95 g/cm^3
Reaction—slightly acid or neutral

Bt horizons:
Hue—10YR or 7.5YR
Value—5 through 7 (3 through 5 moist)
Chroma—3 or 4 dry or moist
Texture—very cobbly, extremely cobbly, or extremely stony silt loam or loam
Rock fragment content—50 to 90 percent
Reaction—moderately acid to neutral

Note: In map units 64 and 78, Lotuspoint soils have extremely acid to strongly acid surface horizons and, in eroded areas, have lost a portion of the volcanic ash mantle.

Marblecreek Series

Depth class: Very deep
Drainage class: Well drained
Landform: Mountains
Parent material: Weathered material derived from schist or quartzite bedrock with a mantle of volcanic ash
Slope range: 15 to 75 percent
Elevation: 2,600 to 5,000 feet
Average annual precipitation: 35 to 50 inches
Average annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 110 days

Taxonomic Class: Loamy-skeletal, mixed, frigid Andic Dystrochrepts

Typical Pedon

Marblecreek, in an area of Bouldercreek-Marblecreek association, 35 to 65 percent slopes, 2 miles southeast of Herrick, Shoshone County, 2,000 feet north and 1,750 feet west of the southeast corner of sec. 16, T. 45 N., R. 3 E.

Oi—1.5 to 1.0 inch; slightly decomposed needles, leaves, and twigs.

Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.

A—0 to 3 inches; brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to weak fine and medium granular; soft, very friable, nonsticky, and slightly plastic; many very fine, fine, and medium roots; many very fine tubular pores; 25 percent pebbles; neutral (pH 7.0); clear wavy boundary.

Bw1—3 to 11 inches; light yellowish brown (10YR 6/4) gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly

plastic; many very fine, fine, and medium and few coarse roots; many very fine and fine tubular pores; 25 percent pebbles and 5 percent cobbles; neutral (pH 6.8); abrupt wavy boundary.

2Bw2—11 to 25 inches; very pale brown (10YR 7/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; many very fine and fine and few medium and coarse roots; many very fine and fine tubular and irregular pores; 40 percent pebbles and 10 percent cobbles; slightly acid (pH 6.2); gradual wavy boundary.

2BC—25 to 44 inches; pink (7.5YR 7/4) extremely gravelly sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and nonplastic; common very fine and fine roots; many very fine and fine irregular pores; many very fine mica flakes; 50 percent pebbles and 20 percent cobbles; slightly acid (pH 6.5); gradual wavy boundary.

2C—44 to 60 inches; pink (7.5YR 7/4) extremely cobbly loamy sand, brown (7.5YR 5/4) moist; massive; soft, very friable, nonsticky, and nonplastic; few very fine and fine roots; many very fine and fine irregular pores; many very fine mica flakes; 45 percent pebbles and 45 percent cobbles; slightly acid (pH 6.5).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 9- to 13-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Value—5 or 6 (3 or 4 moist)
Chroma—2 to 4 dry or moist
Rock fragment content—15 to 25 percent
Bulk density—0.65 to 0.95 g/cm^3

Bw horizon:
Texture—gravelly silt loam or gravelly loam
Rock fragment content—15 to 30 percent
Bulk density—0.65 to 0.95 g/cm^3

2Bw horizon:
Hue—10YR or 7.5YR
Value—6 or 7 (4 or 5 moist)
Chroma—3 or 4 dry or moist
Texture—very gravelly or very cobbly sandy loam, fine sandy loam, or loam
Rock fragment content—35 to 55 percent
Reaction—moderately acid or slightly acid

2C horizon:
Hue—10YR or 7.5YR
Value—7 or 8 (5 or 6 moist)
Chroma—3 or 4 dry or moist
Texture—extremely gravelly, extremely cobbly, or extremely flaggy sandy loam or loamy sand
Rock fragment content—65 to 90 percent
Reaction—moderately acid or slightly acid

Mazie Series

Depth class: Very deep
Drainage class: Very poorly drained
Landform: Concave areas of flood plains
Parent material: Alluvium derived from mixed sources
Slope range: 0 to 2 percent
Elevation: 2,800 to 3,000 feet
Average annual precipitation: 40 to 45 inches
Average annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Fine, mixed, frigid Aquandic Umbraqualfs

Typical Pedon

Mazie silt loam, in an area of Mazie silt loam, 0 to 2 percent slopes, 0.5 mile southeast of Clarkia, Shoshone County, 2,450 feet north and 450 feet east of the southwest corner of sec. 7, T. 42 N., R. 2 E.

A—0 to 7 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; few fine prominent mottles that are strong brown (7.5YR 4/6) when moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; moderately acid (pH 6.0); abrupt wavy boundary.

AB—7 to 11 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; many fine prominent mottles that are strong brown (7.5YR 4/6) when moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine roots; many very fine and fine tubular pores; moderately acid (pH 6.0); clear wavy boundary.

Bg—11 to 20 inches; gray (5Y 6/1) silt loam, dark gray (5Y 4/1) moist; common fine prominent mottles that are strong brown (7.5YR 4/6) and (7.5YR 5/6), and light yellowish brown (2.5Y 6/4) when moist; moderate fine and medium subangular blocky structure; hard, firm, sticky, and slightly

plastic; common very fine roots; many very fine and fine tubular pores; moderately acid (pH 5.8); gradual wavy boundary.
Btg—20 to 38 inches; pale yellow (5Y 8/3) silty clay, pale olive (5Y 6/3) moist; ped surfaces are gray (5Y 5/1) when moist; many fine prominent mottles within peds that are strong brown (7.5YR 4/6) and dark greenish gray (5G 4/1) when moist; moderate medium prismatic structure; very hard, very firm, very sticky, and very plastic; few very fine roots; many very fine and fine tubular pores; few faint clay films on faces of peds and lining pores; moderately acid (pH 6.0); abrupt wavy boundary.
2Cg1—38 to 42 inches; reddish yellow (7.5YR 7/6) loam, strong brown (7.5YR 5/6) moist; many fine and medium prominent mottles that are pale brown (10YR 6/3), light olive gray (5Y 6/2), and dark greenish gray (5G 4/1) when moist; massive; slightly hard, friable, slightly sticky, and plastic; common very fine tubular pores; neutral (pH 7.0); abrupt wavy boundary.
3Cg2—42 to 50 inches; pale yellow (5Y 8/3) silty clay loam, pale olive (5Y 6/3) moist; many medium and large prominent mottles that are strong brown (7.5YR 4/6) and dark greenish gray (5G 4/1) when moist; massive; hard, firm, sticky, and plastic; few very fine tubular pores; neutral (pH 7.0); gradual wavy boundary.
3Cg3—50 to 60 inches; pale yellow (5Y 8/2) silty clay loam, light olive gray (5Y 6/2) moist; common fine and medium prominent mottles that are strong brown (7.5YR 4/6) when moist; massive; very hard, very firm, very sticky, and plastic; few very fine tubular pores; neutral (pH 7.0).

Range in Characteristics

Umbric epipedon thickness: 10 to 16 inches
Depth to high water table: 0 to 18 inches (February to June)

A horizon:
Hue—10YR or 2.5Y
Chroma—1 or 2 dry or moist
Mottles—chroma: 6 to 8 moist
Base saturation—30 to 50 percent
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent
Reaction—moderately acid or slightly acid

Bg horizon:
Hue—2.5Y or 5Y; and chroma—1 or 2 dry or moist
Mottles—hue: 7.5YR, 2.5Y, or 5GY; chroma 1 to 8 moist
Clay content—18 to 27 percent

Btg horizon:
Value—7 or 8 (5 or 6 moist)
Mottles—hue: 7.5YR, 5G, or 5GY
Texture—silty clay or silty clay loam
Clay content—35 to 45 percent

2Cg horizon: (absent in some pedons)

3Cg horizons:
Hue—5Y or 5GY
Value—6 to 8 (4 to 6 moist)
Chroma—1 to 3 dry or moist
Texture—silty clay loam or loam
Thin stratified layers—coarse sandy loam to very fine sandy loam present in some pedons
Reaction—slightly acid or neutral

Meadowport Series

Depth class: Very deep
Drainage class: Moderately well drained
Landform: Dissected terraces
Parent material: Glacial lake-laid sediments and old alluvium derived from granite and schist with a mantle of volcanic ash
Slope range: 15 to 35 percent
Description of complex slopes: Hilly to steep
Elevation: 3,800 to 4,000 feet
Average annual precipitation: 55 to 65 inches
Average annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Taxonomic Class: Fine-silty, mixed Andic Cryoboralfs

Typical Pedon

Meadowport silt loam, in an area of Meadowport silt loam, 15 to 35 percent slopes, 18 miles east of Clarkia, Shoshone County, 100 feet north and 1,100 feet west of the southeast corner of sec. 31, T. 42 N., R. 5 E.

Oi—1.5 to 0.5 inch; slightly decomposed needles, leaves, and twigs.
Oe—0.5 inch to 0; decomposed organic matter.
A—0 to 4 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; common fine rounded iron and manganese concretions; slightly acid (pH 6.5); clear wavy boundary.
Bw—4 to 12 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky

structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine and few medium roots; common very fine and fine tubular pores; common fine rounded iron and manganese concretions; neutral (pH 6.7); clear wavy boundary.

2Bt/E1—12 to 17 inches; mixed light yellowish brown (10YR 6/4) and very pale brown (10YR 7/3) silt loam, dark yellowish brown (10YR 4/4) and brown (10YR 5/3) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; hard, firm, slightly sticky, and slightly plastic; few very fine, fine, and medium roots; common very fine tubular pores; common faint clay films on faces of peds and lining pores; 15 percent E material between peds; slightly acid (pH 6.2); clear wavy boundary.

2Bt/E2—17 to 25 inches; mixed light yellowish brown (10YR 6/4) and very pale brown (10YR 7/3) silt loam, dark yellowish brown (10YR 4/4) and brown (10YR 5/3) moist; moderate coarse prismatic structure parting to weak coarse angular blocky; hard, firm, slightly sticky, and plastic; few very fine roots; common very fine and few fine tubular pores; few faint clay films lining pores; common faint white (10YR 8/2) silt coatings on faces of peds; 15 percent E material between peds; strongly acid (pH 5.5); gradual wavy boundary.

2Btb1—25 to 39 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse subangular blocky structure; hard, firm, sticky, and plastic; few very fine roots; few very fine tubular pores; common faint clay films on faces of peds and lining pores; 5 percent fine garnet pebbles; very strongly acid (pH 5.0); gradual wavy boundary.

2Btb2—39 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; strong coarse subangular blocky structure; very hard, very firm, very sticky, and plastic; few very fine roots; few very fine and fine tubular pores; many faint and common distinct clay films on faces of peds and lining pores; 10 percent fine garnet pebbles; very strongly acid (pH 4.6).

Range in Characteristics

Depth to perched water table: 18 to 30 inches (February to April)

Volcanic ash mantle: 9- to 12-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 80 to 100 percent

A horizon:
Value—5 or 6 (3 or 4 moist)
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

Bw horizon:
Value—5 or 6 (3 or 4 moist
Bulk density—0.65 to 0.85 g/cm^3

2Bt/E horizons:
Clay content—18 to 26 percent
Reaction—strongly acid to slightly acid

2Btb horizons:
Chroma—4 to 6 dry or moist
Clay content—28 to 35 percent
Pebble content—0 to 10 percent (fine)
Reaction—very strongly acid to moderately acid

Miesen Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Landform: Low stream terraces, flood plains, and natural levees
Parent material: Alluvium derived from mixed sources
Slope range: 0 to 4 percent
Description of complex slopes: Undulating
Elevation: 2,130 to 2,240 feet
Average annual precipitation: 28 to 32 inches
Average annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Coarse-silty, mixed, frigid Vitrandic Haplumbrepts

Typical Pedon

Miesen silt loam, in an area of Miesen silt loam, 0 to 2 percent slopes, 3 miles west of St. Joe, Benewah County, 200 feet north and 100 feet east of the southwest corner of sec. 13, T. 46 N., R. 1 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and fine and common medium roots;

many very fine and fine and few medium tubular and irregular pores; strongly acid (pH 5.3); clear wavy boundary.

A2—8 to 26 inches; grayish brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and common fine and medium roots; many very fine and common fine and medium tubular and irregular pores; strongly acid (pH 5.3); clear wavy boundary.

A3—26 to 32 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine and few medium roots; common very fine and few fine tubular and irregular pores; strongly acid (pH 5.4); gradual wavy boundary.

Bw1—32 to 45 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; common fine faint mottles that are dark grayish brown (10YR 4/2) and few fine faint mottles that are dark yellowish brown (10YR 4/4) when moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few very fine roots; few very fine and fine tubular pores; common very fine mica flakes; strongly acid (pH 5.5); clear wavy boundary.

Bw2—45 to 55 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 3/3) moist; common fine and medium faint mottles that are dark yellowish brown (10YR 4/4), dark grayish brown (10YR 4/2), and very dark grayish brown (10YR 3/2) when moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few very fine roots; few very fine tubular pores; common very fine mica flakes; moderately acid (pH 5.6); clear wavy boundary.

Bw3—55 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; common fine and medium faint and distinct mottles that are dark brown (10YR 3/3), very dark grayish brown (10YR 3/2), and dark yellowish brown (10YR 4/4 and 10YR 4/6) when moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few very fine roots; few very fine and fine tubular pores; common very fine mica flakes; moderately acid (pH 5.7).

Range in Characteristics

Depth to high water table: 24 to 42 inches (February to June)
Umbric epipedon: 20 to 48 inches
Reaction: Strongly acid to slightly acid
Buried A and B horizons, thin organic layers, thin volcanic ash layers: present in some pedons

A horizons:
- Value—4 or 5 dry
- Chroma—2 or 3 moist
- Thin stratified layers—very fine sandy loam or fine sandy loam in some pedons
- Base saturation—25 to 40 percent
- Volcanic glass content—5 to 20 percent
- Phosphate retention—25 to 55 percent

Bw horizons:
- Value—5 to 7 (3 to 5 moist)
- Chroma—3 or 4 dry or moist
- Mottles—faint to prominent; hue:10YR or 7.5YR
- Texture—silt loam or very fine sandy loam; some pedons stratified with thin layers of fine sandy loam

2C horizon: (present in some pedons)
- Hue—10YR or 2.5Y
- Value—6 or 7 (4 or 5 moist)
- Chroma—2 to 4 dry or moist
- Mottles— faint to prominent; hue: 10YR or 7.5YR
- Texture—stratified silt loam, very fine sandy loam, fine sandy loam, and loamy fine sand; gravelly in some pedons

Nakarna Series

Depth class: Deep
Drainage class: Well drained
Landform: Mountains and foothills
Parent material: Weathered material derived from micaceous schist bedrock with a thick mantle of volcanic ash
Slope range: 15 to 65 percent
Elevation: 2,800 to 4,800 feet
Average annual precipitation: 35 to 50 inches
Average annual air temperature: 41 to 45 degrees F
Frost-free period: 70 to 100 days

Taxonomic Class: Ashy over loamy, mixed, frigid Typic Udivitrands

Typical Pedon

Nakarna silt loam, in an area of Nakarna silt loam, 35 to 65 percent slopes, 2 miles southeast of Clarkia, Shoshone County, 1,000 feet north and 2,200 feet west of the southeast corner of sec. 17, T. 42 N., R. 2 E.

Oi—2 to 1 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 2 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine and common medium roots; many very fine and fine tubular pores; neutral (pH 6.8); clear wavy boundary.
Bw1—2 to 14 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and fine tubular pores; neutral (pH 7.0); abrupt wavy boundary.
2Bw2—14 to 22 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; many very fine and fine mica flakes; 10 percent soft fragments of decomposed schist; 5 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.
2BC—22 to 34 inches; very pale brown (10YR 7/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common very fine and fine and few medium roots; many very fine and fine irregular pores; many very fine and fine mica flakes; 25 percent soft fragments of decomposed schist; 10 percent pebbles; slightly acid (pH 6.3); gradual wavy boundary.
2C—34 to 47 inches; very pale brown (10YR 7/4) cobbly fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; few very fine roots; common very fine and fine irregular pores; many very fine and fine mica flakes; common medium and coarse strong brown (7.5YR 4/6) moist iron stains; 25 percent soft fragments of decomposed schist; 10 percent pebbles and 10 percent cobbles; slightly acid (pH 6.3); clear wavy boundary.
2Cr—47 inches; highly weathered soft micaceous schist.

Range in Characteristics

Depth to bedrock: 40 to 60 inches
Volcanic ash mantle: 14- to 20-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—2 to 4 dry or moist
Pebble content—0 to 10 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

Bw horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—3 to 6 dry or moist
Pebble content—0 to 10 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

2Bw horizon:
Hue—10YR or 7.5YR
Value—6 or 7 (4 or 5 moist)
Chroma—3 to 6 dry or moist
Texture—loam, very fine sandy loam, fine sandy loam, or silt loam; some pedons are gravelly
Rock fragment content—5 to 25 percent
Soft micaceous schist fragments—0 to 10 percent
Clay bands—few present in some pedons, $^1/_8$- to $^3/_4$-inch thick
Reaction—moderately acid to neutral

2BC horizon: (absent in some pedons)

2C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (4 to 6 moist)
Chroma—3 to 6 dry or moist
Texture—cobbly fine sandy loam, gravelly sandy loam, or fine sandy loam
Rock fragment content—10 to 30 percent
Soft micaceous schist fragments—10 to 50 percent
Reaction—moderately acid to neutral

Odonnell Series

Depth class: Very deep
Drainage class: Moderately well drained

Landform: Foothills
Parent material: Weathered material derived from anorthosite, schist, and gneiss bedrock with a thick mantle of volcanic ash
Slope range: 15 to 35 percent
Description of complex slope: Hilly to steep
Elevation: 2,600 to 4,400 feet
Average annual precipitation: 55 to 65 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Ashy over loamy, mixed, frigid Alfic Udivitrands

Typical Pedon

Odonnell silt loam, in an area of Odonnell silt loam, 15 to 35 percent slopes, 17.5 miles east of Clarkia, Shoshone County, 2,000 feet north and 1,000 feet east of the southwest corner of sec. 35, T. 42 N., R. 4 E.

Oi—3 inches to 1 inch; slightly decomposed needles, leaves, twigs, and bark.
Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 4 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; weak fine subangular blocky structure parting to weak fine granular; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine and fine tubular and irregular pores; few fine and medium iron and manganese concretions; 5 percent fine pebbles; neutral (pH 7.0); clear wavy boundary.
Bw—4 to 14 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine and fine tubular and irregular pores; common fine and medium iron and manganese concretions; 5 percent fine pebbles; neutral (pH 6.8); abrupt wavy boundary.
2E—14 to 16 inches; very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) moist; moderate fine platy structure; hard, firm, slightly sticky, and slightly plastic; few very fine and fine roots; common very fine and fine tubular pores; few faint bleached silt coatings on faces of peds; 5 percent fine pebbles; slightly acid (pH 6.5); clear wavy boundary.
2Bt/E—16 to 22 inches; mixed very pale brown (10YR 8/3) and pink (7.5YR 7/4) silt loam, pale brown (10YR 6/3) and brown (7.5YR 5/4) moist; moderate medium and coarse prismatic structure; very hard, very firm, sticky, and slightly plastic; common very fine and fine roots; common very fine tubular pores; many faint and common distinct clay films on faces of peds and lining pores;
25 percent E material between peds; common faint bleached silt coatings on faces of peds;
10 percent fine pebbles; slightly acid (pH 6.5); clear irregular boundary.
2E/Btb—22 to 37 inches; yellow (10YR 8/6) tongues of silt loam, brownish yellow (10YR 6/6) moist; weak coarse angular blocky structure; hard, firm, slightly sticky, and slightly plastic; interfingered with reddish yellow (7.5YR 7/6) silty clay loam, strong brown (7.5YR 5/6) moist; moderate medium and coarse prismatic structure; very hard, very firm, sticky, and plastic; the E material occupies about 70 percent of the horizon in tongues from 4- to 6-inches thick; few very fine and fine roots; common very fine and fine tubular pores; many faint and common distinct clay films on faces of peds and lining pores of Bt material;
5 percent fine pebbles; strongly acid (pH 5.5) in the E material and slightly acid (pH 6.5) in the Bt material; clear wavy boundary.
2Btb—37 to 50 inches; mixed reddish yellow (5YR 7/6) and (7.5YR 7/6) silty clay loam, yellowish red (5YR 5/6) and strong brown (7.5YR 5/6) moist; moderate coarse angular blocky structure; very hard, very firm, sticky, and plastic; few very fine roots; few very fine and fine tubular pores; common faint clay films on faces of peds and lining pores; 5 percent fine pebbles; moderately acid (pH 5.8); abrupt irregular boundary.
2BC—50 to 60 inches; mixed yellow (10YR 8/6) and reddish yellow (7.5YR 7/6) silt loam, yellow (10YR 7/6) and strong brown (7.5YR 5/6) moist; weak coarse subangular blocky structure; hard, firm, slightly sticky, and slightly plastic; few very fine roots; few very fine and fine tubular pores; few faint clay films on faces of peds and lining pores; 5 percent pebbles and 5 percent cobbles; very strongly acid (pH 5.0).

Range in Characteristics

Depth to perched water table: 18 to 30 inches (February to April)
Depth to bedrock: More than 60 inches
Volcanic ash mantle: 14- to 18-inches thick

Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizon:
Chroma—2 to 4 dry or moist
Pebble content—fine, 0 to 5 percent
Bulk density—0.65 to 0.85 g/cm^3

Bw horizon:
Value—5 or 6 (3 or 4 moist)
Pebble content—fine, 0 to 5 percent
Bulk density—0.65 to 0.85 g/cm^3

2E horizon: (absent in some pedons)
Value—7 or 8 (5 or 6 moist)
Chroma—3 or 4 moist
Pebble content—fine, 0 to 5 percent
Clay content—16 to 20 percent

2Bt/E horizon:
Value—6 to 8 (4 to 6 moist)
Chroma—3 to 6 dry or moist
Texture—loam or silt loam
Pebble content—fine, 0 to 10 percent
Clay content—18 to 26 percent
Base saturation—35 to 50 percent

2E/Btb horizon:
Chroma—3 through 6 moist
Pebble content—fine, 0 to 10 percent
Clay content—24 to 30 percent
Base saturation—35 to 50 percent

2Btb horizon:
Hue—5YR, 7.5YR, or 10YR
Value—6 to 8 (4 to 6 moist)
Chroma—4 to 8 dry or moist
Texture—loam, silty clay loam, or silt loam
Pebble content—fine, 0 to 10 percent
Clay content—24 to 34 percent
Base saturation—35 to 50 percent
Reaction—strongly acid or moderately acid

2BC horizon: (absent in some pedons)
Hue—10YR, 7.5YR, or 5YR
Chroma—4 or 6 moist
Texture—silt loam or fine gravelly loam
Pebble content—fine, 0 to 30 percent
Pebble content—medium and coarse, 0 to 5 percent
Cobble content—0 to 5 percent
Reaction—very strongly acid or strongly acid

Pinecreek Series

Depth class: Very deep
Drainage class: Well drained
Landform: Mountains
Parent material: Weathered material derived from metasedimentary bedrock with a thick mantle of volcanic ash
Slope range: 35 to 75 percent
Elevation: 2,200 to 4,000 feet
Average annual precipitation: 28 to 35 inches
Average annual air temperature: 44 to 46 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Ashy over loamy-skeletal, mixed, frigid Humic Vitrixerands

Typical Pedon

Pinecreek, in an area of Ahrs-Pinecreek association, 35 to 75 percent slopes, 1.1 miles southwest of St. Joe Baldy, Benewah County, 850 feet north and 950 feet east of the southwest corner of sec. 2, T. 46 N., R. 1 W.

Oi—1 inch to 0; slightly decomposed grasses and leaves mixed with Mt. St. Helens volcanic ash.
A1—0 to 3 inches; grayish brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft; very friable, nonsticky, and slightly plastic; many very fine, fine, and common medium and coarse roots; many very fine, common fine, and few medium tubular and irregular pores; 15 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.
A2—3 to 10 inches; brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak fine and medium granular; soft, very friable, nonsticky, and slightly plastic; many very fine, fine, and common medium and coarse roots; common very fine and fine and few medium tubular and irregular pores; 15 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.
Bw1—10 to 22 inches; yellowish brown (10YR 5/4) gravelly silt loam, dark yellowish brown (10YR 3/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and fine and few medium tubular and irregular pores; 20 percent pebbles, 5 percent cobbles, and 5 percent stones; slightly acid (pH 6.3); clear wavy boundary.
2Bw2—22 to 37 inches; light yellowish brown (10YR 6/4) very gravelly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable,

slightly sticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; few very fine, fine, and medium tubular and irregular pores; 30 percent pebbles, 10 percent cobbles, and 10 percent stones; slightly acid (pH 6.3); gradual wavy boundary.

2BC—37 to 50 inches; light yellowish brown (10YR 6/4) extremely cobbly silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and few fine and medium roots; few very fine, fine, and medium tubular and irregular pores; 30 percent pebbles, 30 percent cobbles, and 10 percent stones; slightly acid (pH 6.3); clear wavy boundary.

2C—50 to 60 inches; light yellowish brown (10YR 6/4) extremely cobbly silt loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky, and slightly plastic; few very fine roots; few very fine and fine tubular and irregular pores; 35 percent pebbles, 40 percent cobbles, and 15 percent stones; slightly acid (pH 6.3).

Range in Characteristics

Depth to bedrock: More than 60 inches
Umbric epipedon: 10 to 15 inches
Base saturation: 15 to 25 percent
Reaction: Slightly acid or neutral
Volcanic ash mantle: 14- to 22-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 55 to 90 percent

A horizons:
Value—4 or 5 (2 or 3 moist)
Chroma—1 to 3 dry or moist
Rock fragment content—15 to 25 percent
Bulk density—0.65 to 0.85 g/cm^3

Bw horizon:
Value—5 or 6 (3 or 4 moist
Rock fragment content—15 to 30 percent
Bulk density—0.65 to 0.85 g/cm^3

2Bw horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist
Texture—very gravelly silt loam, very cobbly silt loam, very cobbly loam, or very gravelly loam
Rock fragment content—40 to 60 percent

2C horizon:
Hue—10YR or 7.5YR
Value—6 or 7 (4 or 5 moist)
Texture—extremely gravelly, extremely cobbly, or extremely stony silt loam or loam
Rock fragment content—65 to 90 percent

Note: In map unit 78, Pinecreek soils have very strongly acid to strongly acid surface horizons, and, in eroded areas, have lost a portion of the volcanic ash mantle.

Pokey Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Landform: Flood plains and low stream terraces
Parent material: Alluvium derived from mixed sources
Slope range: 0 to 4 percent
Elevation: 2,200 to 3,100 feet
Average annual precipitation: 35 to 45 inches
Average annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Coarse-loamy over sandy or sandy-skeletal, mixed, frigid Vitrandic Haplumbrepts

Typical Pedon

Pokey, in an area of Pokey-Typic Fluvaquents complex, 0 to 4 percent slopes, 4.5 miles northwest of Clarkia, Shoshone County, 50 feet south and 1,300 feet west of the northeast corner of sec. 22, T. 43 N., R. 1 E.

A1—0 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; 5 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

A2—10 to 15 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; 5 percent pebbles; strongly acid (pH 5.5); gradual wavy boundary.

Bw—15 to 23 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; common fine distinct mottles that are brown (7.5YR 4/2) and strong brown (7.5YR 5/6) when moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine roots; common very fine and

fine tubular pores; 5 percent pebbles; strongly acid (pH 5.3); gradual wavy boundary.

Cg1—23 to 27 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; many medium prominent mottles that are strong brown (7.5YR 5/6) when moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and nonplastic; few very fine and fine roots; common very fine and fine tubular pores; common very fine mica flakes; 5 percent pebbles; moderately acid (pH 6.0); abrupt wavy boundary.

2Cg2—27 to 34 inches; light brownish gray (2.5Y 6/2) loamy sand, dark grayish brown (2.5Y 4/2) moist; many medium distinct and prominent mottles that are light olive brown (2.5Y 5/6) and strong brown (7.5YR 5/6) when moist; single grain; loose, nonsticky, and nonplastic; many fine and medium irregular pores; common very fine mica flakes; few very fine iron and manganese concretions; 10 percent pebbles; moderately acid (pH 6.0); abrupt wavy boundary.

2Cg3—34 to 62 inches; light gray (5Y 7/1) coarse sand, gray (5Y 5/1) moist; many medium prominent mottles that are light olive brown (2.5Y 5/6) and strong brown (7.5YR 5/6) when moist; single grain; loose, nonsticky, and nonplastic; many fine and medium irregular pores; common very fine mica flakes; few very fine iron and manganese concretions; 10 percent pebbles; slightly acid (pH 6.4).

Range in Characteristics

Depth to high water table—18 to 30 inches (February to June)
Umbric epipedon: 10 to 20 inches

A horizons:
Value—4 or 5 (2 or 3 moist)
Pebble content—0 to 5 percent
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent
Reaction—strongly acid to slightly acid

Bw horizon: (absent in some pedons)
Texture—loam or silt loam
Pebble content—0 to 5 percent
Reaction—strongly acid to slightly acid

Bg horizon: (present in some pedons)
Hue—10YR
Value—6 or 7 (4 or 5 moist)
Chroma—2 dry or moist
Mottles—distinct or prominent; hue: 7.5YR; value: 4 or 5 moist; chroma: 2 to 6 moist
Texture—loam or silt loam
Pebble content—0 to 5 percent
Reaction—moderately acid or slightly acid

Cg horizon:
Hue—10YR or 2.5Y
Value—6 or 7 (4 or 5 moist)
Chroma—1 or 2 dry or moist
Mottles—distinct or prominent; value: 4 or 5 moist; chroma: 2 to 6 moist
Texture—very fine sandy loam, loam, or silt loam
Pebble content—0 to 5 percent
Reaction—moderately acid or slightly acid

2Cg horizons:
Hue—2.5Y, 5Y, or 5GY
Mottles—value: 4 or 5 moist; chroma: 4 or 6 moist
Texture—loamy sand, sand, coarse sand; some pedons are gravelly
Pebble content—10 to 35 percent
Reaction—moderately acid to neutral

Ramsdell Series

Depth class: Very deep
Drainage class: Very poorly drained
Landform: Flood plains and low stream terraces
Parent material: Silty alluvium derived from mixed sources
Slope range: 0 to 2 percent
Elevation: 2,130 to 2,200 feet
Average annual precipitation: 28 to 32 inches
Average annual air temperature: 43 to 46 degrees F
Frost-free period: 90 to 120 days

Taxonomic Class: Coarse-silty, mixed, nonacid, frigid Aquandic Endoaquepts

Typical Pedon

Ramsdell silt loam, in an area of Miesen-Ramsdell silt loams, 0 to 4 percent slopes, 1 mile northwest of St. Joe, Benewah County, 1,650 feet south and 750 feet east of the northwest corner of sec. 20, T. 46 N., R. 1 E.

A—0 to 6 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; common fine and medium distinct and prominent mottles that are dark brown (10YR 3/3) and (7.5YR 3/4) and dark yellowish brown (10YR 3/4) when moist; weak fine subangular blocky structure parting to weak fine and medium granular; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, fine, and medium roots; many very fine and fine and few medium tubular and irregular pores; few iron stains lining root channels;

common very fine mica flakes; moderately acid (pH 6.0); clear wavy boundary.

Bg1—6 to 11 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; common fine and medium distinct and prominent mottles that are dark brown (10YR 3/3) and (7.5YR 3/4) and dark reddish brown (5YR 3/4) when moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; few iron stains lining root channels; common very fine mica flakes; moderately acid (pH 5.8); clear wavy boundary.

Bg2—11 to 28 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; common fine and medium prominent mottles that are yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) when moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and few fine and medium roots; common very fine and fine tubular pores; few iron stains lining root channels; moderately acid (pH 5.8); clear wavy boundary.

Bg3—28 to 36 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; common fine and medium prominent mottles that are yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/6) when moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and few fine roots; few very fine and fine tubular pores; few iron stains lining root channels; moderately acid (pH 5.8); abrupt wavy boundary.

Cg1—36 to 55 inches; pale yellow (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; many fine and medium distinct and prominent mottles that are brown (10YR 5/3), gray (10YR 5/1), and strong brown (7.5YR 4/6 and 7.5YR 5/6) when moist; massive; hard, firm, slightly sticky, and slightly plastic; few very fine and fine roots; few very fine, fine, and medium tubular pores; common fine iron and manganese stains; few fine dark organic stains lining pores; strongly acid (pH 5.5); gradual wavy boundary.

Cg2—55 to 62 inches; pale yellow (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; many fine and medium distinct and prominent mottles that are brown (10YR 5/3), gray (10YR 5/1), and strong brown (7.5YR 4/6 and 7.5YR 5/6) when moist; massive; hard, firm, slightly sticky, and slightly plastic; few very fine and fine roots; few very fine, fine, and medium tubular pores; common fine iron and manganese stains; few fine dark organic stains lining pores; strongly acid (pH 5.5).

Range in Characteristics

Depth to high water table: 0 to 18 inches (February to June)

Thin buried layers: Loamy fine sand, fine sandy loam, or very fine sandy loam present in some pedons

A horizon:
Hue—2.5Y or 10YR
Value—3 or 4 moist
Mottles—faint to prominent; chroma: 2 to 6 moist
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent
Reaction—moderately acid or slightly acid

Bg horizons:
Hue—10YR, 2.5Y, or 5Y
Mottles—faint to prominent; chroma: 2 to 6 moist
Reaction—moderately acid or slightly acid

Cg horizons:
Hue—10YR, 2.5Y, or 5Y
Value—6 to 8 (4 to 6 moist)
Mottles—faint to prominent; chroma: 1 to 6 moist
Reaction—strongly acid to slightly acid

Redraven Series

Depth class: Very deep
Drainage class: Well drained
Landform: Glacial troughs
Parent material: Glacial till derived from gneiss, schist, or quartzite rocks with a thick mantle of volcanic ash
Slope range: 15 to 35 percent
Description of complex slope: Hilly to steep
Elevation: 4,200 to 6,000 feet
Average annual precipitation: 40 to 55 inches
Average annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Taxonomic Class: Medial over loamy-skeletal, mixed Vitric Haplocryands

Typical Pedon

Redraven bouldery silt loam, in an area of Redraven bouldery silt loam, 15 to 35 percent slopes, 11 miles southwest of Avery, Shoshone County, 1,950 feet south and 100 feet west of the northeast corner of sec. 12, T.44 N., R.3 E.

Oi—2 to 1 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter.
A—0 to 2 inches; brown (10YR 5/3) bouldery silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to moderate fine granular; soft, very friable, nonsticky, and slightly plastic; many very fine and fine roots; many very fine and fine tubular pores; 5 percent pebbles and 5 percent cobbles, 10 percent stones and boulders; boulders cover 0.1 percent of the surface; neutral (pH 7.0); clear irregular boundary.
Bw1—2 to 8 inches; pale brown (10YR 6/3) bouldery silt loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and fine tubular pores; 5 percent pebbles and 5 percent cobbles, 10 percent stones and boulders; neutral (pH 7.0); clear wavy boundary.
Bw2—8 to 17 inches; light yellowish brown (10YR 6/4) bouldery silt loam, dark yellowish brown (10YR 4/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and fine tubular pores; 10 percent pebbles, 5 percent cobbles, and 10 percent stones and boulders; neutral (pH 7.0); abrupt wavy boundary.
2Bw3—17 to 29 inches; light yellowish brown (10YR 6/4) very bouldery loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; common fine and medium roots; common very fine and fine irregular and few fine tubular pores; 20 percent pebbles, 15 percent cobbles, and 25 percent stones and boulders; neutral (pH 6.8); clear wavy boundary.
2BC—29 to 44 inches; pale yellow (2.5Y 7/4) extremely bouldery sandy loam, light olive brown (2.5Y 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; few fine and medium roots matted along rock faces; common very fine tubular and irregular pores; 30 percent pebbles, 20 percent cobbles, and 30 percent stones and boulders; moderately acid (pH 5.8); gradual wavy boundary.
2C—44 to 60 inches; pale yellow (2.5Y 7/4) extremely bouldery loamy sand, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots on rock faces; many very fine and fine irregular pores; few medium brownish yellow (10YR 6/8) iron stains; 35 percent pebbles, 20 percent cobbles, and 35 percent stones and boulders; moderately acid (pH 6.0).

Range in Characteristics

Surface stones and boulders: 0 to 0.1 percent
Volcanic ash mantle: 14- to 20-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 80 to 100 percent

A horizon:
Value—4 to 6 (3 or 4 moist)
Chroma—2 or 3 dry or moist
Texture—bouldery silt loam or cobbly silt loam
Rock fragment content—15 to 25 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

Bw horizons:
Hue—10YR or 7.5YR
Value—5 or 6 dry, 3 or 4 moist
Texture—bouldery silt loam or cobbly silt loam
Rock fragment content—15 to 30 percent
Bulk density—0.65 to 0.85 g/cm^3
Reaction—slightly acid or neutral

2Bw horizon:
Hue—10YR or 7.5YR
Value—5 to 7 (4 or 5 moist)
Texture—very stony, very cobbly, or very bouldery loam, silt loam, or sandy loam
Rock fragment content—35 to 60 percent
Reaction—moderately acid to neutral

2C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (4 to 6 moist)
Chroma—3 or 4 moist
Texture—extremely stony, extremely cobbly, or extremely bouldery sandy loam or loamy sand
Rock fragment content—70 to 90 percent
Reaction—moderately acid to slightly acid

Reggear Series

Depth class: Moderately deep to a fragipan
Drainage class: Moderately well drained
Landform: Terraces
Parent material: Loess deposits with minor amounts of volcanic ash
Slope range: 3 to 30 percent
Description of complex slopes: Undulating to hilly
Elevation: 2,500 to 3,400 feet
Average annual precipitation: 30 to 40 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Fine-silty, mixed Vitrandic Fragiboralfs

Typical Pedon

Reggear silt loam, in an area of Reggear silt loam, 3 to 20 percent slopes, 2 miles southeast of Fernwood, Benewah County, 800 feet south and 950 feet east of the northwest corner of sec. 5, T. 43 N., R. 1 E.

Oi—2 to 1 inch; undecomposed needles, leaves, and twigs.

Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.

A1—0 to 1 inch; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, fine, and medium and few coarse roots; many very fine and fine irregular pores; neutral (pH 6.8); clear wavy boundary.

A2—1 to 5 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate fine and medium platy structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, fine, and medium and few coarse roots; many very fine and fine tubular pores; neutral (pH 6.6); gradual wavy boundary.

BA—5 to 11 inches; yellowish brown (10YR 5/4) silt loam, dark yellowish brown (10YR 3/4) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine, fine, and medium roots; many very fine and fine tubular pores; neutral (pH 6.6); gradual wavy boundary.

Bt—11 to 18 inches; light yellowish brown (10YR 6/4) silt loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure; hard, firm, sticky, and slightly plastic; common very fine, fine, and medium roots; many very fine and fine tubular pores; common distinct clay films on faces of peds and lining pores; slightly acid (pH 6.4); gradual wavy boundary.

Bt/E—18 to 23 inches; mixed light yellowish brown (10YR 6/4) and very pale brown (10YR 8/3) silt loam, dark yellowish brown (10YR 4/4) and pale brown (10YR 6/3) moist; moderate medium prismatic structure; hard, firm, sticky, and slightly plastic; few very fine and fine roots, some roots flattened along faces of peds; many very fine and fine tubular and few fine vesicular pores; common distinct clay films on faces of peds and lining pores; few fine and medium strong brown (7.5YR 5/6) iron stains in E material; 25 percent E material between peds; moderately acid (pH 6.0); gradual irregular boundary.

E—23 to 24 inches; very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; few very fine and fine roots; many very fine and fine tubular pores; common fine and medium strong brown (7.5YR 5/6) iron stains; moderately acid (pH 5.8); abrupt wavy boundary.

Btx/E—24 to 60 inches; mixed light brown (7.5YR 6/4) and very pale brown (10YR 7/3) silty clay loam, brown (7.5YR 4/4) and (10YR 5/3) moist; strong medium and coarse prismatic structure; extremely hard, extremely firm and brittle, sticky, and plastic; few very fine and fine roots as flattened mats on faces of peds; many very fine, fine, and medium tubular and vesicular pores; continuous prominent clay films on faces of peds and lining pores; E material on tops of prisms and in tongues between prisms; many medium strong brown (7.5YR 5/6) iron stains in E material between prisms; dark organic and manganese stains on faces of prisms; moderately acid (pH 5.8).

Range in Characteristics

Depth to fragipan: 20 to 40 inches
Depth to perched water table: 18 to 36 inches (February to April)

A horizons:
Value—4 or 5 dry
Chroma—2 or 3 dry or moist
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent
Reaction—slightly acid or neutral

BA horizon: (absent in some pedons)
Value—5 or 6 (3 to 5 moist)
Chroma—3 or 4 dry or moist
Reaction—moderately acid to neutral

Bt horizon:
Value—6 or 7 (4 or 5 moist)
Chroma—3 or 4 dry or moist
Clay content—22 to 26 percent
Bulk density—1.40 to 1.60 g/cm^3
Reaction—moderately acid to neutral

Bt/E horizon:
Value—6 to 8 (4 to 6 moist)
Chroma—2 to 4 dry or moist
Texture—silt loam or silt

Clay content—E material is 10 to 15 percent; Bt material is 22 to 26 percent
Bulk density—1.40 to 1.60 g/cm^3
Reaction—moderately acid or slightly acid

E horizon:
Value—7 or 8 (5 or 6 moist)
Chroma—2 or 3 dry or moist
Texture—silt loam or silt
Clay content—10 to 15 percent
Bulk density—1.30 to 1.50 g/cm^3
Reaction—strongly acid to slightly acid

Btx/E horizon:
Value—5 to 7 (3 to 5 moist)
Clay content—30 to 40 percent
Bulk density—1.70 to 1.85 g/cm^3
Reaction—strongly acid to slightly acid

Sly Series

Depth class: Very deep
Drainage class: Well drained
Landform: Dissected terraces
Parent material: Loess deposits with minor amounts of volcanic ash overlying basalt
Slope range: 3 to 40 percent
Description of complex slopes: Undulating to hilly
Elevation: 2,160 to 3,400 feet
Average annual precipitation: 30 to 40 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Taxonomic Class: Fine-loamy, mixed Vitrandic Glossoboralfs

Typical Pedon

Helmer silt loam, in an area of Helmer-Sly silt loams, 3 to 25 percent slopes, 1.5 miles east of St. Maries, Benewah County, 3,100 feet south and 1,100 feet west of the northeast corner of sec. 24, T. 46 N., R. 2 W.

Oi—1.5 to 0.75 inches; slightly decomposed needles, leaves, and twigs.
Oe—0.75 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 3 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure parting to weak very fine and fine granular; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine, common fine, and few medium tubular pores; slightly acid (pH 6.5); clear wavy boundary.
BA—3 to 9 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine and few medium and coarse roots; many very fine, common fine, and few medium tubular pores; slightly acid (pH 6.3); clear wavy boundary.
Bt1—9 to 20 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; hard, firm, slightly sticky, and slightly plastic; common very fine and few fine and medium roots; many very fine, common fine, and few medium tubular pores; common faint and few distinct clay films on faces of peds and lining pores; moderately acid (pH 5.8); clear wavy boundary.
Bt2—20 to 36 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; moderate coarse and very coarse angular blocky structure; hard, firm, slightly sticky, and slightly plastic; common very fine and few fine roots; many very fine and fine and few medium tubular pores; many faint and common distinct clay films on faces of peds and lining pores; strongly acid (pH 5.5); clear wavy boundary.
Bt3—36 to 60 inches; mixed pale brown (10YR 6/3) and brown (10YR 5/3) silty clay loam, brown (10YR 4/3) and dark brown (10YR 3/3) moist; moderate coarse and very coarse angular blocky structure; hard, firm, sticky, and plastic; few very fine and fine roots; many very fine and fine and few medium tubular pores; common distinct and few prominent clay films on faces of peds and lining pores; 10 percent pebbles; strongly acid (pH 5.5).

Range in Characteristics

Depth to bedrock: More than 60 inches

A horizon:
Hue—10YR or 7.5YR
Chroma—2 to 4 dry or moist
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent
Reaction—slightly acid or neutral

BA horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Chroma—3 or 4 dry or moist
Texture—silt loam or loam

Volcanic glass content—5 to 20 percent
Reaction—slightly acid or neutral

Bt horizons:
Hue—10YR or 7.5YR
Value—5 to 7 (3 to 5 moist)
Chroma—3 to 6 dry or moist
Texture—silt loam, loam, silty clay loam, or clay loam; some pedons may be gravelly in lower part
Rock fragment content—0 to 20 percent in the lower part
Clay content—18 to 27 percent in the upper part; 25 to 38 percent in the lower part
Base saturation—50 to 60 percent
Reaction—strongly acid to slightly acid

C horizon: (present in some pedons)
Hue—10YR or 7.5YR
Value—6 to 8 (4 to 6 moist)
Chroma—3 to 6 dry or moist
Texture—silt loam, loam, or clay loam; some pedons are gravelly or cobbly
Rock fragment content—0 to 25 percent
Clay content—20 to 30 percent
Reaction—strongly acid to slightly acid

Tigley Series

Depth class: Very deep
Drainage class: Well drained
Landform: Foothills, dissected terraces, and breaklands
Parent material: Colluvium and old alluvium derived from metasedimentary rocks with a mantle of loess and minor amounts of volcanic ash
Slope range: 30 to 80 percent
Elevation: 2,160 to 3,600 feet
Average annual precipitation: 30 to 38 inches
Average annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 120 days

Taxonomic Class: Loamy-skeletal, mixed Vitrandic Glossoboralfs

Typical Pedon

Tigley, in an area of Tigley-Hugus association, 30 to 65 percent slopes, 1.6 miles southwest of St. Joe Baldy, Benewah County, 550 feet north and 2,650 feet west of the southeast corner of sec. 11, T. 46 N., R. 1 W.

Oi—1.0 to 0.5 inch; slightly decomposed needles, leaves, and twigs.

Oe—0.5 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.

A—0 to 3 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; slightly hard, friable, slightly sticky, and slightly plastic; many very fine and common fine and medium roots; many very fine and common fine tubular and irregular pores; 10 percent pebbles and 5 percent cobbles; neutral (pH 6.8); clear wavy boundary.

BA—3 to 10 inches; yellowish brown (10YR 5/4) gravelly loam, dark yellowish brown (10YR 3/4) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine and few medium and coarse roots; common very fine and few fine tubular and irregular pores; 15 percent pebbles and 5 percent cobbles; slightly acid (pH 6.5); gradual wavy boundary.

Bt1—10 to 19 inches; light reddish brown (5YR 6/4) cobbly loam, reddish brown (5YR 4/4) moist; moderate fine and medium angular blocky structure; hard, firm, slightly sticky, and slightly plastic; common very fine and few fine and medium roots; common very fine and few fine tubular pores; common faint clay films on faces of peds and few faint and distinct clay films lining pores; few faint pinkish white (5YR 8/2) coatings on faces of peds; 10 percent pebbles and 10 percent cobbles; strongly acid (pH 5.5); clear wavy boundary.

Bt2—19 to 33 inches; reddish yellow (5YR 6/6) extremely cobbly loam, yellowish red (5YR 4/6) moist; moderate fine and medium angular blocky structure; hard, firm, slightly sticky, and slightly plastic; common very fine and few fine roots; common very fine and few fine tubular pores; common faint clay films on faces of peds and few faint and distinct clay films lining pores; few faint pinkish white (5YR 8/2) coatings on faces of peds; 30 percent pebbles, and 30 percent cobbles, and 10 percent stones; strongly acid (pH 5.5); clear wavy boundary.

Bt3—33 to 49 inches; mixed reddish yellow (5YR 6/6) and red (2.5YR 5/6) very cobbly loam, yellowish red (5YR 4/6) and dark red (2.5YR 3/6) moist; moderate fine and medium angular blocky structure; hard, firm, slightly sticky, and slightly plastic; few very fine and fine roots; common very fine and few fine and medium tubular pores; few faint and distinct clay films on faces of peds and lining pores; few faint pinkish white (5YR 8/2) coatings on faces of peds; 20 percent pebbles, 20

percent cobbles, and 5 percent stones; strongly acid (pH 5.5); clear wavy boundary.
Bt4—49 to 60 inches; mixed reddish yellow (5YR 6/6) and red (2.5YR 5/6) very cobbly loam, yellowish red (5YR 4/6) and dark red (2.5YR 3/6) moist; weak medium angular blocky structure; hard, firm, slightly sticky, and slightly plastic; few very fine and fine roots; common very fine and few fine tubular pores; common faint and few distinct clay films on faces of peds and lining pores; 15 percent soft fragments of decomposed metasedimentary rock; 20 percent pebbles, 25 percent cobbles, and 5 percent stones; strongly acid (pH 5.4).

Range in Characteristics

A horizon:
Hue—10YR or 7.5YR
Chroma—2 to 4 dry or moist
Texture—gravelly loam or extremely gravelly loam
Rock fragment content—15 to 70 percent
Volcanic glass content—5 to 20 percent
Phosphate retention—25 to 55 percent
Reaction—slightly acid or neutral

BA horizon:
Hue—10YR or 7.5YR
Value—5 or 6 (3 or 4 moist)
Texture—cobbly or gravelly loam or silt loam
Rock fragment content—15 to 30 percent
Reaction—moderately acid to neutral

Bt horizons:
Hue—10YR, 7.5YR, 5YR, or 2.5YR
Value—5 to 8 (3 to 6 moist)
Chroma—4 to 8 dry or moist
Texture upper part—cobbly, gravelly, very cobbly, or very gravelly loam or silt loam
Texture lower part—very cobbly, very gravelly, extremely cobbly, or extremely gravelly loam, silt loam, or silty clay loam
Rock fragment content—20 to 45 percent in the upper part; 45 to 75 percent in the lower part
Clay content—18 to 28 percent
Base saturation—35 to 50 percent
Reaction—very strongly acid to moderately acid

Note: In map unit 86, Tigley soils have very strongly acid to strongly acid surface horizons, which, because of erosion, contain less volcanic ash.
Note: In map unit 87, Tigley soils have very strongly acid to extremely acid surface horizons. These surface horizons have soft bedrock at depths of 40 to 60 inches and have less volcanic ash because of erosion.

Typic Fluvaquents

Depth class: Moderately deep to sand, gravel, and cobbles
Drainage class: Very poorly drained
Landform: Flood plains and low stream terraces
Parent material: Mixed alluvium derived from granite, schist, and quartzite
Slope range: 0 to 2 percent
Elevation: 2,200 to 3,100 feet
Average annual precipitation: 35 to 45 inches
Average annual air temperature: 42 to 45 degrees F
Frost-free period: 80 to 110 days

Typical Pedon

Typic Fluvaquents, in an area of Pokey-Typic Fluvaquents complex, 0 to 4 percent slopes, 4.5 miles northwest of Clarkia, Shoshone County, 200 feet north and 2,500 feet west of the southeast corner of sec. 15, T. 43 N., R. 1 E.

A—0 to 3 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct light olive brown (2.5Y 5/4) mottles; weak fine and medium subangular blocky structure; soft, very friable, slightly sticky, and slightly plastic; many very fine and fine and medium roots; common very fine and fine tubular pores; moderately acid (pH 6.0); gradual wavy boundary.
Cg1—3 to 7 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; common fine and medium prominent brownish yellow (10YR 6/6) and olive yellow (2.5Y 6/6) mottles; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine and fine roots; common very fine and few fine tubular pores; 5 percent pebbles; moderately acid (pH 5.8); gradual wavy boundary.
Cg2—7 to 18 inches; light olive gray (5Y 6/2) very fine sandy loam, olive gray (5Y 4/2) moist; many fine prominent yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/6) mottles; massive; slightly hard, friable, nonsticky, and slightly plastic; few very fine and fine roots; common very fine and few fine tubular pores; 5 percent pebbles; moderately acid (pH 6.0); abrupt wavy boundary.
2Cg3—18 to 37 inches; gray (5Y 6/1) loamy sand, gray (5Y 5/1) moist; few fine prominent brownish yellow (10YR 6/6) and olive yellow (2.5Y 6/6) mottles; single grain; loose, nonsticky, and nonplastic; many very fine irregular pores; 10 percent pebbles; slightly acid (pH 6.2); abrupt wavy boundary.

3Cg4—37 to 60 inches; gray (5Y 6/1) very gravelly coarse sand, gray (5Y 5/1) moist; single grain; loose, nonsticky, and nonplastic; many very fine irregular pores; 45 percent pebbles and 5 percent cobbles; slightly acid (pH 6.2).

Range in Characteristics

Depth to high water table: 0 to 18 inches (February to June)
Depth to sand, gravel, and cobbles: 20 to 40 inches

A horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 or 6 (3 or 4 moist)
Chroma—1 to 3 dry or moist
Pebble content—0 to 10 percent

C horizons (upper and middle):
Hue—2.5Y, 5Y, 5GY, or 5BG
Chroma—1 or 2 dry or moist
Texture—stratified silt loam to loamy coarse sand
Pebble content—5 to 10 percent
Reaction—moderately acid or slightly acid

C horizons (lower):
Hue—5Y, 5GY, or variegated
Value—6 or 7 (4 or 5 moist)
Texture—stratified gravelly coarse sand to extremely gravelly coarse sand
Pebble content—25 to 60 percent
Cobble content—0 to 15 percent
Reaction—moderately acid or slightly acid

Udarents

Depth class: Very deep
Drainage class: Somewhat poorly drained
Landform: Low stream terraces
Parent material: Mixed alluvium derived from metasedimentary rocks, mine tailings, mine dredgings, and slickens
Slope range: 0 to 4 percent
Elevation: 2,250 to 3,200 feet
Average annual precipitation: 30 to 45 inches
Average annual air temperature: 43 to 47 degrees F
Frost-free period: 80 to 130 days

Typical Pedon

Udarents, in an area of Udarents-Aquic Udifluvents-Slickens complex, 0 to 4 percent slopes, 0.5 miles north of Smelterville, Shoshone County, 1800 feet north and 700 feet east of the southwest corner of sec. 35, T. 49 N., R. 2 E.

C1—0 to 20 inches; mixed and stratified layers of dark gray (2.5Y 4/0) extremely gravelly fine sandy loam and pale brown (10YR 6/3) very gravelly loamy fine sand, very dark gray (2.5Y 3/0) and brown (10YR 4/3) moist; single grain; loose, nonsticky, and nonplastic; no roots; many very fine and fine irregular pores; 70 percent rounded pebbles and 5 percent cobbles in the dark gray material and 40 percent rounded pebbles in the pale brown material; high concentrations of heavy metals; neutral (pH 7.0) in the dark gray material and moderately acid (pH 6.0) in the pale brown material; abrupt wavy boundary.

C2—20 to 25 inches; pale yellow (2.5Y 7/4) extremely gravelly very fine sandy loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; no roots; common very fine and fine irregular pores; 60 percent pebbles, 10 percent cobbles, and 10 percent stones, rock fragments are angular; strongly acid (pH 5.2); abrupt discontinuous boundary.

C3—25 to 26 inches; dark gray (2.5Y 4/0) extremely gravelly fine sandy loam, very dark gray (2.5Y 3/0) moist; single grain; loose, nonsticky, and nonplastic; no roots; many very fine irregular pores; 80 percent rounded pebbles; neutral (pH 7.0); abrupt wavy boundary.

C4—26 to 41 inches; mixed reddish yellow (7.5YR 7/6) and (7.5YR 6/8) silt loam, strong brown (7.5YR 5/6) and (7.5YR 5/8) moist; colors are in thin wavy stratifications 1- to 2-mm thick; few fine prominent mottles that are light gray (10YR 6/1) when moist; massive; hard, firm, slightly sticky, and slightly plastic; very brittle; no roots; few very fine irregular pores; 10 percent wood and charcoal fragments; neutral (pH 6.8); abrupt wavy boundary.

C5—41 to 50 inches; mixed pale brown (10YR 6/3) and pinkish gray (7.5YR 7/2) silt loam, brown (10YR 4/3) and (7.5YR 5/2) moist; few fine distinct mottles that are light gray (10YR 6/1) when moist; mixed colors are in thin wavy stratifications; massive; slightly hard, friable, slightly sticky, and slightly plastic; no roots; few very fine and fine irregular pores; common large vesicular pores coated with material similar to the C4 horizon; organic stains in lower part of horizon that are dark brown (7.5YR 3/2) when moist; common fine manganese concretions; 5 percent wood fragments; strongly acid (pH 5.2); abrupt wavy boundary.

C6—50 to 60 inches; mixed very pale brown (10YR 7/4) and pale yellow (2.5Y 8/2) gravelly very fine sandy loam, yellowish brown (10YR 5/4) and light brownish gray (2.5Y 6/2) moist; many fine distinct mottles that are yellowish brown (10YR 5/8) when moist; massive; slightly hard, friable, nonsticky,

and slightly plastic; no roots; few very fine and fine irregular pores; many fine and medium manganese concretions; thin stratified layers of loamy sand; 15 percent pebbles; moderately acid (pH 5.8).

Range in Characteristics

Depth to high water table: 36 to 54 inches (February to May)

C horizons (upper):
Hue—7.5YR, 10YR or 2.5Y
Texture—mixed and stratified loam, very fine sandy loam, fine sandy loam, loamy very fine sand, loamy fine sand or fine sand; may be nongravelly to extremely gravelly
Rock fragment content—0 to 80 percent
Reaction—strongly acid to neutral

C horizons (middle): (absent in some pedons)
Hue—7.5YR, 10YR, or 2.5Y
Value—5 to 7 (3 to 5 moist)
Chroma—2 to 8 dry or moist
Texture—silt loam, mucky silt loam, or loam
Rock fragment content—0 to 5 percent
Reaction—strongly acid to neutral

C horizons (lower):
Value—6 to 8 (4 to 6 moist)
Chroma—0 to 4 dry or moist
Texture—stratified very fine sandy loam, fine sandy loam, sandy loam, loamy sand, coarse sand or fine sand; may be nongravelly to extremely gravelly or extremely cobbly
Rock fragment content—0 to 80 percent
Reaction—strongly acid to neutral

Buried A, E, and Bt horizons: (present in some pedons):
Hue—10YR
Value—5 to 8 (3 to 6 moist)
Chroma—2 to 4 dry or moist
Texture—silt, silt loam, or loam
Rock fragment content—0 to 10 percent
Reaction—strongly acid to neutral

Vaywood Series

Depth class: Very deep
Drainage class: Well drained
Landform: Mountains and ridges
Parent material: Weathered material derived from schist or quartzite bedrock with a thick mantle of volcanic ash
Slope range: 15 to 75 percent
Elevation: 4,600 to 6,500 feet
Average annual precipitation: 40 to 55 inches
Average annual air temperature: 38 to 42 degrees F
Frost-free period: 30 to 60 days

Taxonomic Class: Medial over loamy-skeletal, mixed Vitric Haplocryands

Typical Pedon

Vaywood silt loam, in an area of Vaywood silt loam, 15 to 35 percent slopes, 3.75 miles southwest of the Marblecreek, Shoshone County, 2,150 feet south and 2,100 feet east of the northwest corner of sec. 28, T. 45 N., R. 3 E.

Oi—1.75 to 1.0 inch; slightly decomposed needles, leaves, and twigs.
Oe—1 inch to 0; decomposed organic matter mixed with Mt. St. Helens volcanic ash.
A—0 to 5 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; many very fine and fine, common medium, and few coarse roots; many very fine and fine tubular pores; 10 percent pebbles; neutral (pH 6.8); gradual wavy boundary.
Bw1—5 to 20 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky, and slightly plastic; common very fine, fine, and medium and few coarse roots; common very fine and few fine tubular pores; 10 percent pebbles; slightly acid (pH 6.5); clear wavy boundary.
2Bw2—20 to 32 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky, and slightly plastic; common very fine and fine and few medium roots; common very fine and fine tubular pores; 30 percent pebbles and 5 percent cobbles; moderately acid (pH 5.8); clear wavy boundary.
2BC—32 to 44 inches; very pale brown (10YR 7/4) very cobbly sandy loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable, nonsticky, and slightly plastic; few very fine and fine roots; many very fine irregular pores; many very fine mica flakes; 25 percent pebbles, 30 percent cobbles, and 5 percent stones; moderately acid (pH 5.6); clear wavy boundary.
2C1—44 to 50 inches; very pale brown (10YR 8/4) extremely cobbly sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, nonsticky, and slightly plastic; few very fine and fine roots; many very fine irregular pores;

many very fine and fine mica flakes; 15 percent pebbles, 50 percent cobbles, and 10 percent stones; strongly acid (pH 5.5); clear wavy boundary.

2C2—50 to 60 inches; very pale brown (10YR 8/4) extremely stony sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, nonsticky, and nonplastic; few very fine roots; many very fine irregular pores; many very fine and fine mica flakes; 10 percent pebbles, 40 percent cobbles, and 40 percent stones; strongly acid (pH 5.5).

Range in Characteristics

Depth to bedrock: More than 60 inches
Volcanic ash mantle: 14- to 24-inches thick
Volcanic glass content: 30 to 65 percent
Phosphate retention: 80 to 100 percent

A horizon:
- Chroma—2 through 4 dry or moist
- Pebble content—0 to 10 percent
- Bulk density—0.65 to 0.85 g/cm^3

Bw horizon:
- Value—5 or 6 (3 or 4 moist)
- Chroma—3 or 4 dry or moist
- Pebble content—5 to 15 percent
- Bulk density—0.65 to 0.85 g/cm^3
- Reaction—slightly acid or neutral

2Bw horizon:
- Chroma—3 or 4 dry or moist
- Texture—very gravelly or very cobbly silt loam, loam, or sandy loam
- Rock fragment content—35 to 60 percent
- Reaction—moderately acid or slightly acid

2BC horizon: (absent in some pedons)
- Hue—10YR or 2.5Y
- Value—6 or 7 (4 or 5 moist)
- Chroma—3 or 4 dry or moist
- Texture—very gravelly or very cobbly sandy loam or loam
- Rock fragment content—40 to 60 percent
- Reaction—moderately acid or slightly acid

2C horizons:
- Hue—10YR or 2.5Y
- Value—7 or 8 (5 or 6 moist)
- Texture—extremely cobbly or extremely stony loamy fine sand, sandy loam, fine sandy loam, or loamy sand
- Rock fragment content—65 to 90 percent
- Reaction—strongly acid or moderately acid

Formation of the Soils

Soil is a natural, three-dimensional body on the earth's surface. Soil has properties that result from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over a period of time.

Although there are many different soils, each soil is the result of the interaction of the same five factors. These factors are the physical and chemical composition of the parent material, the effect of climate on the parent material, the kinds of plants and organisms living in the soil, the relief of the land, and the length of time it took for the soil to form.

Within short distances, the combination of these factors varies, and, consequently, the soils that form differ in fertility, productivity, and physical and chemical characteristics. In the following paragraphs, the factors of soil formation are discussed as they relate to the soils in the survey area.

Parent Material

Soils in the survey area formed in residual, alluvial, and eolian parent materials.

The most extensive geologic units in the area are the Belt Series of Precambrian metasedimentary rocks (Ross and Forrester, 1958). These metamorphosed rocks, mainly siltite, argillite, and quartzite, occur throughout the area (U.S. Department of the Interior, 1973). They are highly fractured rocks, and most soils that have formed in materials derived from them have a high percentage of coarse fragments. The Ahrs, Honeyjones, Lotuspoint, and Pinecreek soils are typical of this group. These soils also contain loess transported from central Washington during the late Pleistocene and Holocene epochs. Volcanic ash from volcanoes in the Cascade Mountains to the west was also deposited during the Pleistocene and Holocene epochs (USDA, 1984).

The volcanic ash in the area originated from many active volcanoes in western Washington and western Oregon including Mt. St. Helens, Mt. Rainier, and Glacier Peak. The greatest contribution of ash in this area, however, came about 6,700 years ago from the eruption of Mt. Mazama, the cone of which is now Crater Lake, in southwestern Oregon. The Mazama ashfall was the only ashfall of sufficient extent and thickness to have significantly affected the soils in the survey area. It fell over the entire area but has eroded from places that did not have a full cover of trees. Soils, such as the Bouldercreek, Helmer, Hobo, and Honeyjones soils, have retained volcanic ash and are strongly influenced by this material.

Basalt flows of the Columbia River Group have formed plateaus throughout the survey area. In most places, the basalt is covered by thick deposits of loess and volcanic ash. On terrace escarpments and canyon slopes, the loess and volcanic ash have been eroded away, and the basalt is closer to the surface. Agatha, Bobbitt, Dorb, and Lacy soils formed on these escarpments and have a high percentage of basalt rock fragments mixed with thin surficial deposits of loess and volcanic ash.

Other soils were formed in the metamorphosed, coarse- or medium-grained, igneous rocks of the Idaho Batholith. These soils are also influenced by loess and volcanic ash. The Blackprince, Garveson, Jacot, and Keeler soils are examples.

Alluvium in the survey area is generally of local origin. It is derived from stream-transported material of the adjacent uplands. Because of the wide variety of sedimentary, metamorphic, and igneous rocks in the uplands, the alluvium contains a wide variety of material. Alluvium on small drainageways, generally, has texture and other characteristics that are similar to the material of the surrounding hills from which the sediment was eroded. The Clarkia soil is an example.

Alluvium in the St. Joe and Coeur d'Alene River valleys was deposited by streams that overflowed their channels. Distant sediment was deposited as water spread over the flood plain. Where floodwaters moved slowly, silt and very fine sands were deposited. Soils such as the Miesen and Ramsdell soils have formed in alluvium with these textures. The Bellslake soil contains peat and muck that was deposited in former ponds and lakes within the flood plain.

Climate

Temperature and precipitation mainly determine climate, an active force in the formation of soils. Soils

form in rocks that have been broken into suitable materials by erosion and alternate freezing and thawing. Water and wind are active agents in transporting and separating weathered material. Chemical reactions, such as solution and hydration, further break down this weathered material. Precipitation and temperature affect the kind and amount of native vegetation that grows on the soil. As vegetation decays, it produces organic matter that subsequently becomes part of the soil.

The climate in the survey area is generally subhumid. It has warm, relatively dry summers and cold, wet winters. Areas in the mountains have cooler summers and colder winters than areas in the valleys.

Differences in annual precipitation and temperature are generally associated with changes in elevation. The greatest amount of precipitation occurs in the high mountain areas of the eastern part of the survey area. At some locations, the mean annual precipitation is 50 inches or more. The mean annual rainfall in the St. Maries area is about 30 inches per year. The mean annual temperature ranges from about 38 or 42 degrees F in the higher mountains of the eastern part of the survey area to 47 degrees F in the western part of the survey area.

Soils, such as the Bouldercreek, Honeyjones, and Nakarna soils, in the cool, wet parts of the survey area support native vegetation dominated by a dense canopy of conifers. They have a thin, light-colored surface layer (A horizon), are low in organic matter, and are leached of bases. Soils, such as the Bobbitt, Lotuspoint, and Pinecreek soils, that have formed in the warmer and drier parts of the survey area support a more open-tree canopy and an understory of grass. These soils have a thicker, darker-colored surface layer and contain more humus and exchangeable bases. Soils that formed under grass are higher in organic matter than soils that formed under trees because the annual dieback of grass roots is incorporated into the soil.

Relief

Relief, or topography, is determined by the uplift of mountain masses and the resistance of bedrock and geologic formations to erosion by water and wind. The survey area includes four predominant physiographic units: the St. Joe and Coeur d'Alene mountains and the St. Joe and Coeur d'Alene River valleys. The mountains rise 3,000 to 4,000 feet above the valleys and are moderately steep to very steep with numerous drainageways. The valleys lying below the mountains are nearly level to gently sloping.

Relief influences soil development through its effects on drainage and runoff. The relief of the survey area closely affects the local climate. The air temperature and the amount of precipitation can vary greatly within short distances. For example, annual rainfall ranges from 30 inches at St. Maries to more than 50 inches in the mountains, about eight miles away.

Honeyjones soils on north-facing slopes receive less direct sunlight, have colder soil temperatures, and retain moisture longer than Pinecreek soils on south-facing slopes, which are warmer and dry out faster. Because of these differences, the plant cover on these two soils is different. Honeyjones soils, generally, are more leached of exchangeable bases while Pinecreek soils have a thicker, darker-colored surface layer.

The mountains of the survey area have long, winding ridges and relatively steep side slopes. Some ridges are broad and have slopes that range from 5 to 25 percent. Other ridges are narrower and have slopes that are greater than 25 percent. In the mountains, generally, depth to bedrock, amount of rock fragments, and number and distinctness of soil horizons are affected by steepness and shape of slope. Soils on steep convex slopes generally have a greater amount of rock fragments, are shallower to bedrock, and have fewer and less distinct soil horizons. Examples of moderately deep, steep and very steep soils are Blackprince, Bobbitt, and Lotuspoint.

The St. Joe and Coeur d'Alene River flood plains are relatively flat. Because of the level topography, drainage is poor, and drainage outlets are lacking. Lack of drainage causes a seasonal high or fluctuating water table. The Bellslake, Miesen, and Ramsdell soils have formed on these flood plains under water-tolerant plants. Because of poor drainage, these soils have gleyed underlying horizons and brown and yellowish red mottles, which indicate the intense reduction of iron. The Helmer and Hobo soils, which have formed on terraces above the flood plain, do not have a seasonal high water table. They are moderately well drained and do not have gleying and mottles.

Living Organisms

Living organisms are active in the formation of soils. Plants, animals, insects, and microorganisms affect gains or losses in organic matter, plant nutrients in the soil, and changes in porosity and structure.

Roots, rodents, and insects penetrate the soil and alter its structure. Microorganisms, chemicals in the

soil, and insects change leaves, roots, and entire plants that remain in the surface layer to humus. Fungi and algae also contribute to the decomposition of bedrock. Animals increase porosity by burrowing through the soil and leaving open channels for the movement of water and air.

The poorly drained soils of the flood plains and valley bottoms of the survey area formed under water-tolerant grasses, sedges, and forbs. Examples are the Bellslake, Clarkia, Mazie, and Miesen soils. During soil formation, drainage was poor; water was readily available; and native plants grew abundantly. These soils provide a good habitat for microorganisms, which leads to the decomposition and incorporation of organic matter into the soil. Consequently, these soils contain a large amount of organic matter and are some of the darkest-colored soils in the survey area.

Time

Change taking place in soils over a long period of time is called soil genesis. As a result of these changes, distinct horizons, or layers, develop in the soils. The length of time that parent materials have been in place and exposed to climate and living organisms is generally reflected in the degree to which the soil profile has developed. The kind and arrangement of these horizons are called soil morphology. These layers are described in terms of color, texture, structure, consistence, thickness, permeability, and chemistry.

Soils are classified according to their approximate age, from young to mature. Age, or maturity, of a soil is generally indicated by the thickness and distinctness of subsurface horizons, content of organic matter and clay, depth to which soluble material is leached, and form and distribution of calcium carbonate and gypsum in the soil.

Young soils in the survey area include soils on flood plains. The Miesen and Pokey soils formed in recently deposited, unconsolidated sediment. These soils have accumulated enough organic matter over time to form an A horizon and are, generally, leached of bases.

The Helmer, Hobo, and Reggear soils are on old dissected terraces. These soils are considered the oldest soils in the survey area because they have the most strongly differentiated horizons. They have had sufficient time for the translocation of silicate clay minerals. They have developed thick, dense Bt and Btx horizons with overlying light-colored, leached E horizons.

Many of the sloping and steep, shallow and very shallow soils appear to have been in the process of formation for about as long as some of the more developed, less sloping soils. However, erosion has removed the soil as fast as it formed. In this case, the effect of time has been offset by the effect of relief.

References

Alexander, R.R., 1967. Site indexes for Engelmann spruce. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper, RP-32.

American Association of State Highway and Transportation Officials (AASHTO). 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1993. Standard classification of soils for engineering purposes. ASTM Standard D 2487-00.

Cochran, P.H. 1979. Gross yields for even-aged stands of Douglas-fir and white or grand fir east of the Cascades in Oregon and Washington. U.S. Department of Agriculture, Forest Service. Pacific Northwest Forest and Range Experiment Station Research Paper PNW-263.

Cochran, P.H. 1979. Site index and height growth curves for managed, even-aged stands of Douglas-fir east of the Cascades in Oregon and Washington. U.S. Department of Agriculture, Forest Service. Pacific Northwest Forest and Range Experiment Station Research Paper PNW-251.

Cochran, P.H. 1979. Site index and height growth curves for managed, even-age stands of white or grand fir east of the Cascades in Oregon and Washington. U.S. Department of Agriculture, Forest Service. Pacific Northwest Forest and Range Experiment Station Research Paper PNW-252.

Cooper, S.V., K.E. Neiman, R. Steele, and D.W. Roberts. 1987. Forest habitat types of northern Idaho: a second approximation. U.S. Department of Agriculture, Forest Service, General Technical Report INT-236.

Haig, I.T. 1932. Second-growth yield, stand and volume tables for the western white pine type. U.S. Department of Agriculture, Forest Service. Northern Rocky Mountain Forest Experiment Station Technical Bulletin 323.

Meyer, W.H. 1938. Yield of even-aged stands of ponderosa pine. U.S. Department of Agriculture, Technical Bulletin 630. Washington, DC.

Ross, C.P. and J.D. Forrester. 1958. Outline of the geology of Idaho. Idaho Bureau of Mines and Geology Bulletin No. 15.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

United States Department of Agriculture. 1957. Soil. United States Department of Agriculture Yearbook.

United States Department of Agriculture, Bureau of Chemistry and Soils. 1930. Soil Survey of Benewah County, Idaho.

United States Department of Agriculture, Forest Service. 1974. Proposed field draft report—St. Joe River study.

United States Department of Agriculture, Soil Conservation Service. 1989. Interim soil survey of Silver Valley area, Idaho—part of Shoshone County.

United States Department of Agriculture, Soil Conservation Service. 1984. Glossary of selected geomorphic terms for western soil surveys.

United States Department of Agriculture, Soil Conservation Service. 1982. National list of scientific plant names. Technical Publication 159, volumes 1 and 2.

United States Department of Agriculture, Soil Conservation Service. 1980. Soil survey of Benewah County area, Idaho.

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

United States Department of the Interior. 1973. Geologic map of the Spokane quadrangle, Washington, Idaho, and Montana. U.S. Geological Survey Map I-768.

United States Environmental Protection Agency. 1986. Interim site characterization report for the Bunker Hill site, Shoshone County, Idaho.

Glossary

Acidity. This limitation indicates that the soil is so acid that the growth of plants is affected or restricted. (See Reaction, soil for classes.)

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillite. Weakly metamorphosed mudstone or shale.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3.75
Low	3.75 to 5.0
Moderate	5.0 to 7.5
High	more than 7.5

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid material that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Bouldery. Refers to a soil with .01 to 0.1 percent of the surface covered with boulders.

Boundary, horizon. A zone or transitional layer between two adjoining horizons or layers, roughly parallel to the soil surface. Boundaries vary in distinctness and topography.

Breaklands or Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brittle. Consistence of a moist soil ped that ruptures suddenly under pressure rather than to deform slowly.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chroma, soil color. (See Munsell notation.)

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeters in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clayey soil. Silty clay, sandy clay, or clay.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Clearcut. A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from the adjacent stands.

Closed depression. A low area completely surrounded by higher ground and having no natural outlet.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Codominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above but comparatively little from the sides.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conglomerate. A coarse-grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer-textured material. Conglomerate is the consolidated equivalent of gravel.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

Consolidated sandstone. Sandstone that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry, are not easily crushed, and cannot be textured by the usual field method.

Consolidated shale. Shale that disperses within a few hours when fragments are placed in water. The fragments are extremely hard or very hard when dry and are not easily crushed.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Dominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above and from the sides.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown, and yields are low.

Well drained.—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well-drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet, at or near the surface, during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

Dune. A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Erosion hazard. An estimation of the severity of soil loss that could occur on a bare, disturbed soil without benefit of cover for protection. Classes are slight, moderate, severe, and very severe.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: Scarp.

Even aged. Refers to a stand of trees in which only small differences in age occur between individual trees. A range of 20 years is allowed.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well-preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It is commonly on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. Area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (300 meters) and fringes a mountain range or high-plateau escarpment.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface profile is dominantly concave. In terms of gradational processes, a footslope is a transitional zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glacial trough. A broad, elongate U-shaped valley developed by glacial movement.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to

grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Gypsum. A mineral consisting of hydrous calcium sulfate.

Habitat type. An aggregation of all land areas capable of producing similar climax plant communities.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Heavy metal. Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 8 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual" (Soil Survey Division Staff, 1993). The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A or E horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Hue, soil color. (See Munsell notation.)

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is

assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Inclusion, soil. Areas of minor soil components or miscellaneous areas within a map unit that are too small to be delineated separately at the defined scale of mapping. Soil inclusions are listed in each map unit description.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Load supporting capacity. (See Low strength.)

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy soil. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Loess. Fine-grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redox concentration.

Mean annual increment (MAI). The average annual increase in volume of a tree during its entire life.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Metasedimentary rock. Sedimentary rock of any origin that is partially altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Examples are the Belt series of rocks that include siltite, argillite, and quartzite.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Muck. Dark, finely divided, well-decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Overstory. The trees in a forest that form the upper crown cover.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water or air to move downward through the profile.

Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Potential natural plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regeneration. The new growth of a natural plant community, developing from seed.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, boulders, stones, cobbles, and gravel.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Rubble land. Areas that have more than 90 percent of the surface covered by stones or boulders. Voids contain no soil material and virtually no vegetation other than lichens. The areas commonly are at the base of mountain slopes, but some are on mountain slopes as deposits of cobbles, stones, and boulders left by Pleistocene glaciation or by periglacial phenomena.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Salinity. The electrical conductivity of a saline soil. It is expressed, in millimhos per centimeter, as follows:

Nonsaline	0 to 4
Slightly saline	4 to 8
Moderately saline	8 to 16
Strongly saline	more than 16

Sand. As a soil separate, individual rock or mineral fragments from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil

textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy soil. Sand or loamy sand.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike. All the soils of a given series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shallow soil. A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeters). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant or dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading onto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slickens. Accumulations of fine textured material, such as material separated in placer-mine and ore-mill operations. Slickens from ore mills commonly consist of freshly ground rock that has undergone chemical treatment during the milling process.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 4 percent
Moderately sloping	4 to 8 percent
Strongly sloping	8 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 45 percent
Very steep	more than 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slumping. The soil mass is susceptible to movement downslope, usually with a backward rotation, when loaded, excavated, or wet.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with tillage, or stones cover .01 to 0.1 percent of the surface. Very stony means that 0.1 to 3.0 percent of the surface is covered with stones. Extremely stony means that 3 to 15 percent of the surface is covered with stones.

Stony soil material. Soil that is 15 to 35 percent, by volume, rock fragments that are dominated by fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned flood plain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Summit. A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic

textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.

Understory. Any plants in a forest community that grow to a height of less than 5 feet.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Value, soil color. (See Munsell notation.)

Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Volcanic ash mantle. A surface layer of soil that contains 30 percent or more volcanic glass, covering older soil material. It has low bulk density and high water holding capacity.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Water table. A saturated zone of free water in the soil.

Wetness (in tables). The soil is wet from saturation by a high water table during the period of use.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The action of uprooting and tipping over trees by the wind.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1961-1990 at Kellogg, Idaho)

Month	Temperature (Degrees F)						Precipitation (Inches)				
				2 Years in 10 Will Have--				2 Years in 10 Will Have--			
	Average Daily Maximum	Average Daily Minimum	Average Daily	Maximum Temperature Higher Than	Minimum Temperature Lower Than	Average Number of Growing-Degree Days*	Average	Less Than	More Than	Average Number of Days With 0.10 Inch or More	Average Snowfall
January-----	35.1	20.9	28.0	52	-9	4	3.83	2.18	5.30	10	15.4
February----	42.0	24.6	33.3	60	-2	13	2.70	1.52	3.75	8	7.6
March-------	48.8	28.6	38.7	70	8	57	2.68	1.81	3.47	9	4.3
April-------	58.4	33.9	46.1	84	23	197	2.27	1.30	3.13	7	1.1
May---------	67.9	40.4	54.2	92	27	435	2.46	1.38	3.42	6	0.0
June--------	76.2	47.0	61.6	98	34	647	2.19	1.15	3.10	5	0.0
July--------	85.0	50.0	67.5	102	37	853	1.09	0.48	1.75	2	0.0
August------	84.6	49.0	66.8	102	36	825	1.46	0.40	2.31	3	0.0
September---	73.8	42.0	57.9	95	28	537	1.76	0.53	2.76	4	0.0
October-----	59.9	34.1	47.0	84	20	228	2.10	0.81	3.19	6	0.1
November----	44.0	28.8	36.4	63	7	38	3.52	2.08	4.81	9	5.3
December----	34.9	21.8	28.3	54	-10	6	3.96	2.44	5.32	11	14.7
Yearly:											
Average---	59.2	35.1	47.1	———	———	———	———	———	———	———	———
Extreme---	111.0	-36.0	———	104	-16	———	———	———	———	———	———
Total-----	———	———	———	———	———	3,837	30.01	21.88	35.14	80	48.5

See footnote at end of table.

Table 1.--Temperature and Precipitation--Continued

(Recorded in the period 1961-1990 at St. Maries, Idaho)

Month	Temperature (Degrees F)						Precipitation (Inches)				
				2 Years in 10 Will Have--				2 Years in 10 Will Have--			
	Average Daily Maximum	Average Daily Minimum	Average Daily	Maximum Temperature Higher Than	Minimum Temperature Lower Than	Average Number of Growing-Degree Days*	Average	Less Than	More Than	Average Number of Days With 0.10 Inch or More	Average Snowfall
January-----	34.3	22.3	28.3	51	-10	4	4.07	2.07	5.82	9	15.8
February----	41.9	26.1	34.0	60	-2	14	2.87	1.38	4.16	8	7.1
March-------	49.8	29.6	39.7	70	10	70	2.72	1.62	3.70	8	3.0
April-------	58.7	34.0	46.4	83	22	203	2.20	1.24	3.05	6	0.5
May---------	67.6	40.3	53.9	91	28	431	2.16	1.39	2.86	6	0.0
June--------	75.9	47.0	61.4	96	34	638	1.99	1.21	2.69	5	0.0
July--------	85.1	49.9	67.5	101	37	847	1.00	0.35	1.60	2	0.0
August------	84.9	49.0	67.0	102	36	835	1.34	0.36	2.21	3	0.0
September---	74.4	42.0	58.2	96	26	545	1.24	0.51	1.94	3	0.0
October-----	59.7	34.6	47.1	83	19	236	1.78	0.52	2.80	6	0.2
November----	42.5	29.9	36.2	61	8	36	3.38	1.98	4.62	10	5.8
December----	34.4	23.7	29.1	51	-10	4	3.85	2.11	5.39	10	13.3
Yearly:											
Average---	59.1	35.7	47.4	——	——	——	——	——	——	——	——
Extreme---	109.0	-29.0	——	103	-16	——	——	——	——	——	——
Total-----	——	——	——	——	——	3,863	28.61	20.65	32.12	76	45.9

* A growing-degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold: 40.0 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1961-1990 at Kellogg and St. Maries, Idaho)

Probability	Temperature		
	24 Degrees F or lower	28 Degrees F or lower	32 Degrees F or lower
KELLOGG:			
Last freezing temperature in spring: January-July			
1 year in 10 later than----	April 19	May 7	June 9
2 years in 10 later than---	April 12	April 30	June 1
5 years in 10 later than---	March 30	April 18	May 17
First freezing temperature in fall: August-December			
1 year in 10 earlier than--	October 3	September 16	September 5
2 years in 10 earlier than-	October 11	September 25	September 13
5 years in 10 earlier than-	October 26	October 12	September 27
SAINT MARIES:			
Last freezing temperature in spring: January-July			
1 year in 10 later than----	April 21	May 13	May 31
2 years in 10 later than---	April 13	May 6	May 25
5 years in 10 later than---	March 30	April 23	May 15
First freezing temperature in fall: August-December			
1 year in 10 earlier than--	October 2	September 13	September 5
2 years in 10 earlier than-	October 12	September 21	September 10
5 years in 10 earlier than-	October 29	October 7	September 21

Table 3.--Growing Season

(Recorded in the period 1961-1990 at Kellogg and St. Maries, Idaho)

Probability	Daily Minimum Temperature		
	Higher than 24 degrees F	Higher than 28 degrees F	Higher than 32 degrees F
	Days	Days	Days
KELLOGG:			
9 years in 10	174	140	96
8 years in 10	186	153	109
5 years in 10	209	176	134
2 years in 10	232	199	159
1 year in 10	244	212	171
SAINT MARIES:			
9 years in 10	173	131	101
8 years in 10	186	143	110
5 years in 10	210	164	127
2 years in 10	234	186	144
1 year in 10	247	198	153

Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.